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June 10, 2016

VIA EMAIL AND U.S. MAIL

Danny Luong, Senior Manager
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765
dluong@aqmd.gov

Re: Comments on the Proposed Title V Significant Permit Revisions for Tesoro Refining & Marketing Co. LLC's Carson and Wilmington Sites (Facility ID Nos. 174655 and 800436)

Dear Mr. Luong:

We are writing on behalf of Safe Fuel and Energy Resources California ("SAFER California"), Peter Estrada, Leonardo Parra and Nicolas Garcia to provide comments on the South Coast Air Quality Management District's ("Air District") proposed Title V Significant Permit Revisions for Tesoro Refining & Marketing Co. LLC's ("Applicant") Carson and Wilmington sites (Facility ID Nos. 174655 and 800436, respectively). To implement its proposed Los Angeles Refinery Integration and Compliance Project ("Project"), the Applicant submitted 13 applications for revisions to the Title V permits for its Carson site (567643, 567645, 567646, 567647, 567648, 567649, 575837, 575838, 575839, 575840, 575841, 578248 and 578249) and five applications for revisions to the Title V permits for its Wilmington site (567619, 567439, 575874, 575875 and 575876).

The Project will interconnect operations at the two sites. Among other components, the Project will increase processing capability at the Wilmington site by 6,000 barrels per day by increasing the firing rate of Heater H-100 which serves the fractionator column of the Delayed Coking Unit at the Wilmington site. In addition, the Project would increase the capacity of the Hydrocracker Unit at the Carson site by approximately 10 percent. The Project also includes modifications to

the Liquified Petroleum Gas ("LPG") Railcar Loading/Unloading Rack, enabling the Carson site to unload an additional 4,000 barrels per day of LPG.

The modifications covered in the proposed Title V Significant Permit Revisions cover only a fraction of the changes described in the Air District's Draft Environmental Impact Report ("DEIR") for the Project. Specifically, the proposed Title V revisions cover two heaters (Wilmington Heater H-100 and Carson No. 51 vacuum heater), the shutdown of the Wilmington FCCU, additions of various non-emitting equipment, modifications to the No. 5 Flare System, and various fugitive emission sources. There are numerous remaining components of the Project that are not covered in the proposed Title V revisions.

We reviewed the Air District's proposed Title V revisions with the help of technical expert Phyllis Fox, Ph.D., QEP, PE, DEE,[1] and found that: (1) the proposed Title V modifications for both the Wilmington and Carson Operations are inconsistent with many of the assumptions used in the DEIR to analyze the change in emissions from the Project; and (2) that the modifications for both the Wilmington and Carson Operations allow much higher emission increases of NOx than assumed in the DEIR. If the Title V emissions changes were used in the DEIR's operational emission analysis, the Project would result in significant emission increases of NOx.[2] Therefore, either the Air District must revise the Title V permits to ensure that the assumed emission reductions in the DEIR are achieved, or the Air District must revise the DEIR to use the Project's correct emission increases.

I. STATEMENT OF INTEREST

SAFER California advocates for safe processes at California refineries to protect the health, safety, the standard of life and the economic interests of its members. For this reason, SAFER California has a strong interest in enforcing environmental laws which require the disclosure of potential environmental impacts of, and ensure safe operations and processes for, California oil refineries. Failure to adequately address the environmental impacts of crude oil and fuel products transport, refining, storage and distribution processes poses a substantial

[1] Dr. Fox's comments and curriculum vitae are attached and submitted in addition to the comments in this letter.
[2] The DEIR concluded that the Project would not result in any significant changes in emissions (see DEIR, Table 4.2-4).

threat to the environment, worker health, surrounding communities, and the local economy.

Refineries and fuel storage and distribution facilities are uniquely dangerous and capable of generating significant fires and the emission of hazardous and toxic substances that adversely impact air quality, water quality, biological resources and public health and safety. These risks were recognized by the Legislature and Governor when enacting SB 54 (Hancock). Absent adequate disclosure and mitigation of hazardous materials and processes, refinery workers and surrounding communities may be subject to chronic health problems and the risk of bodily injury and death.

Poorly planned refinery and fuel products storage and distribution projects also adversely impact the economic wellbeing of people who perform construction and maintenance work in these facilities and the surrounding communities. Plant shutdowns in the event of accidental release and infrastructure breakdown have caused prolonged work stoppages. Such nuisance conditions and catastrophic events impact local communities and can jeopardize future jobs by making it more difficult and more expensive for businesses to locate and people to live in the area. The participants in SAFER California are also concerned about projects that carry serious environmental risks and public service infrastructure demands without providing countervailing employment and economic benefits to local workers and communities.

The members represented by the participants in SAFER California live, work, recreate and raise their families in Los Angeles County, including in or near the City of Carson and the community of Wilmington. Accordingly, these people would be directly affected by the Project's adverse environmental impacts. The members of SAFER California's participating unions may also work at the facility itself. They will, therefore, be first in line to be exposed to any hazardous materials, air contaminants, and other health and safety hazards, that exist onsite.

These comments are also submitted on behalf of individuals who reside and/or work in the Project area, including Peter Estrada, Leonardo Parra and Nicolas Garcia.

II. WILMINGTON TITLE V PERMIT MODIFICATIONS

A. The Proposed Modifications to the DCU H-100 Heater would Increase Daily Criteria Pollutant Emissions

The Project increases the firing rate of heater H-100 by 20 percent, from the design heat release basis of 252 MMBtu/hr to the maximum heat release basis of 302.4 MMBtu/hr.[3] The increased firing rate will increase emissions (in direct proportion).[4] Notably, however, the DEIR concluded that the increased firing rate would ***reduce*** emissions of all criteria pollutants except for SOx. Dr. Fox explains in her attached comments that the Air District achieved these reductions by artificially inflating the baseline emissions.[5]

The DEIR reports the following emissions reductions for heater H-100:

- NOx: -171.03 lbs/day
- CO: -5.14 lbs/day
- PM10: -0.98 lb/day
- PM2.5: -0.98 lb/day
- VOC: -0.43 lb/day

The Air District must revise the Title V permit to impose enforceable emission limits ensuring that these reductions are achieved, and the Air District must revise the DEIR to correct the heater H-100 emission calculations using the correct baseline (daily average emissions in the years 2012 and 2013, ***not*** the 98th percentile of the maximum emissions).

Further, the application for the heater H-100 firing rate states that, "Tesoro does not propose to increase the potentials to emit for this heater."[6] Yet, as Dr. Fox points out, "the proposed daily SOx limit of 250 lbs/day and the proposed daily ROG limit of 35 lbs/day are much higher than the potential to emit for heather H-100."[7] The 8 lbs/day difference between the proposed ROG limit and potential to emit (27 lbs/day) tips the total Project ROG emissions of 49.09 lbs/day over the Air District's

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[3] DEIR, pp. 1-11, 1-12.
[4] **Attachment A**: Letter from Dr. Phyllis Fox to Rachael Koss, June 9, 2016, p. 3 ("Fox Comments").
[5] *Id.*
[6] SCAQMD Application 567439, pdf 14.
[7] Fox Comments, p. 3.

CEQA significance threshold of 55 lbs/day.[8] Notably, the DEIR operational emissions analysis assumes that the H-100 duty bump would *reduce* VOC emissions. Contrary to its application, Tesoro does, indeed, propose to increase the potentials to emit for heater H-100, and the proposed Title V permit does nothing to ensure that the emission assumptions in the DEIR are achieved.

B. Permit Conditions A195.XX and A195.YY Allow for Exceedances of 1-Hour NOx and SOx Ambient Air Quality Standards

Draft permit Condition S11.X sets an hourly limit on NOx of 18.4 lbs/hr and on SOx of 14.08 lbs/hr. These hourly emission limits are consistent with emissions used in the criteria pollutant air quality modeling for heater H-100.[9] However, Dr. Fox points out that other conditions in the draft permit "weaken these limits by specifying an averaging time that allows exceedances of these 1-hour limits to be averaged out."[10] Specifically, Condition A195.XX provides that compliance with the "hourly" NOx limit is based on a rolling 24-hour average. Similarly, Condition A195.YY provides that compliance with the 1-hour SOx limit is based on a rolling 24-hour average. According to Dr. Fox, "[t]his type of averaging convention allows much higher hourly emissions than were assumed in the criteria pollutant modeling, which was performed to demonstrate compliance with ambient air quality standards."[11] Dr. Fox goes on to explain that a rolling 24-hour average "smooths out emissions data and eliminates peak hourly values that would otherwise exceed the hourly values used in the air dispersion modeling analysis and limited in Condition S11.X."[12] A rolling 24-hour average "guts the intent of the 1-hour limit in Condition S11.X, which is essential to assure that hourly average ambient air quality standards are not exceeded."[13]

Dr. Fox points out that this problem is particularly critical for NOx. This is because the DEIR reports a 1-hour average NOx concentration of 301.4 ug/m^3, compared to the State 1-hour ambient air quality standard of 339 ug/m^3. The DEIR also reports a total 1-hour average NOx concentration of 184.9 ug/m^3, compared to the federal 1-hour ambient air quality standard of 188 ug/m^3. The values reported in the DEIR are very close to the State and federal standards. Thus, if the modeled

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[8] *Id.*
[9] *Id.*
[10] *Id.*, p. 4.
[11] *Id.*
[12] *Id.*
[13] *Id.*

NOx concentration increased by just 3.2 ug/m^3, from 38.6 ug/m^3 to 41.8 ug/m^3, the total NOx concentration would exceed the federal 1-hour NOx standard.[14] According to Dr. Fox, given the Air District's proposed permit conditions allowing the use of a 24-hour rolling average, it "is readily foreseeable" that the total NOx concentration would exceed the federal 1-hour NOx standard.[15] In Dr. Fox's opinion, the rolling 24-hour average may also allow violations of the 1-hour SOx State (655 ug/m^3) and federal (196 ug/m^3) ambient air quality standards.[16] The proposed 24-hour averaging times allows potentially significant unmitigated air quality impacts. Therefore, the Air District must eliminate the rolling average conventions in Conditions A195.XX and A195.YY.

C. Proposed Permit Condition A99.X Allows for Exceedance of Hourly NOx Limit

Proposed permit Condition A99.X sets an exception to the new 18.40 lbs/hr hourly NOx limit as follows:

> The 18.40 lb/hr NOx emission limit(s) shall not apply during the heater startup, shutdowns or refractory dryout periods. For the purpose of this exception, each startup event shall not exceed 48 hours, not including refractory dryout period up to 48 additional hours and each shutdown event shall not exceed 24 hours.

Dr. Fox explains that this exception is problematic for three reasons. First, it "would allow unlimited increases in NOx emissions, sufficient to violate the State and federal 1-hour NOx ambient air quality standards."[17] Second, automatic exemptions from permit limits during startup and shutdowns are not permitted.[18] Finally, the DEIR did not evaluate the impact of this exception (i.e., exemptions from hourly NOx limits) on ambient air quality.[19] Therefore, the Air District must eliminate the exception in Condition A99.X.

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[14] *Id.*
[15] *Id.*
[16] *Id.*
[17] *Id.*, p. 5.
[18] *Sierra Club v. Environmental Protection Agency*, 2008 WL 5264663 (D.C. Cir. Dec. 19, 2008).
[19] Fox Comments, p. 5.

D. Stack Tests are Insufficient to Ensure Compliance with Emission Limits

The draft permit provides that compliance with the emission limits for PM10, ROG and CO would be determined using an annual stack test,[20] while compliance with NOx and SOx limits would be based on the use of a continuous emission monitoring system ("CEMS"). Dr. Fox explains that "annual stack tests are staged events and are thus not adequate to assure that emission limits are met routinely under all operating conditions."[21] Since CEMS are available for ROG and CO, Dr. Fox recommends that CEMS be required to determine compliance with the proposed ROG and CO emission limits.[22] Dr. Fox points out that accurately verifying compliance with the ROG limit is particularly important because the Air District "is in serious nonattainment with ozone ambient air quality standards."[23]

III. CARSON TITLE V PERMIT MODIFICATIONS

A. The Proposed Permits Allows for Greater Emissions from the Carson No. 51 (D63) Vacuum Unit Heater than Were Analyzed in the DEIR

The Applicant proposes to modify Carson No. 51 Vacuum Unit Heater (D63) to increase the maximum permitted firing rate from 276.95 MMBtu/hr to 360 MMBtu/hr.[24] The increase in firing rate will increase emissions.[25] The draft permit sets new limits in Conditions A99.X1 (startup and shutdown exemption), A195.X1 (NOx 24 hr average), B61.8 (fuel gas H_2S limit), C1.X1 (heat input limit) and D29.X1 (test methods). The draft permit sets the following emission limits for the vacuum unit heater:

- CO: 29.6 lbs/MMSCF[26] natural gas
- PM: 6.3 lbs/MMSCF natural gas
- VOC: 5.9 lbs/MMSCF natural gas

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[20] Wilmington Draft Title V Permit, Condition A63.XX.
[21] Fox Comments, p. 5.
[22] *Id.*
[23] *Id.*
[24] DEIR, p. B-3-56.
[25] Fox Comments, p. 6.
[26] MMSCF = millions of standard cubic feet.

- NOx: 2.62 lbs/day natural gas.[27]

Dr. Fox converted these limits into pounds per day, assuming the maximum firing rate of 360 MMBtu/hr and the higher heating value of natural gas (1050 MMBtu/MMSCF):

- CO: 244 lbs/day (DEIR:247 lbs/day)
- PM: 52 lbs/day (DEIR: 53 lbs/day)
- VOC: 48 lbs/day (DEIR: 50 lbs/day)
- NOx: 2.62 lbs/day (DEIR: 3.93 lbs/day)

These are consistent with the limits in Condition A63.3. However, Dr. Fox points out that these limits allow greater emissions than were analyzed in the DEIR.[28] Thus, the Air District must adjust the limits to reflect the DEIR analysis.

The proposed permit further allows for greater emissions from the vacuum unit heater than were analyzed in the DEIR because: (1) Condition A99.X1 exempts the 2.62 lbs/hr NOx limit during startup and shutdowns for up to 48 hours; and (2) Condition A195.X1 specifies that the 2.62 lbs/hr limit is based on a 24-hour rolling average. The startup and shutdown exception is problematic for three reasons. First, it could cause violations of the State and federal 1-hour NOx ambient air quality standards.[29] Second, automatic exemptions from permit limits during startup and shutdowns are not permitted.[30] Finally, the DEIR did not evaluate the impact of this exception (i.e., exemptions from hourly NOx limits) on ambient air quality.[31] Therefore, the Air District must eliminate the exception in Condition A99.X1. The 24-hour rolling average is problematic because it allows much higher NOx emissions than assumed in the DEIR. According to Dr. Fox, these higher NOx emissions could cause violations of the State and federal 1-hour NOx ambient air quality standards, and exceed the Air District's 55 lbs/day NOx CEQA significance threshold.[32]

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[27] Carson Draft Title V Permit, pdf 1.
[28] Fox Comments, p. 6.
[29] *Id.*
[30] *Sierra Club v. Environmental Protection Agency*, 2008 WL 5264663 (D.C. Cir. Dec. 19, 2008).
[31] Fox Comments, pp. 6-7.
[32] *Id.*, p. 7.

B. The Proposed Permit Contains No Limit on SOx in lb/day or lb/MMSCF for the Vacuum Unit Heater

The proposed permit limit for the vacuum unit heater is 162 ppmv of H_2S in the fuel gas, averaged over three hours and excluding any vent gas from emergency malfunction, process upset or relief valve leakage.[33] Dr. Fox explains that "this concentration limit is equivalent to 4.8 lbs/hr of H_2S. When the fuel is combusted, it converts to SO_2. Thus, the proposed limit on H_2S concentration in the fuel gas is equivalent to an SO_2 emission rate limit of 9.6 lb/hr or 230 lb/day."[34] Yet, the DEIR assumes the daily controlled SO_2 emissions from the vacuum unit heater are 4.94 lbs/day[35] and the net increase in SO_2 from the increased firing rate is 1.80 lbs/day.[36] Thus the proposed permit allows greater emissions from the vacuum unit heater than were analyzed in the DEIR. According to Dr. Fox, when the increase in SO_2 allowed from the vacuum unit heater is combined with other Project SO_2 emission increases and decreases (as reported in DEIR Table 4.2-4), the Project SO_2 emissions are 230 lbs/day.[37] This exceeds the Air District's SO_2 significance threshold of 150 lbs/day.[38] Thus, the proposed Title V permit allows a significant air quality impact not disclosed in the DEIR.

C. Stack Tests are Insufficient to Ensure Compliance with Emission Limits

The draft permit provides that compliance with the emission limits for PM, ROG, NOx and CO would be determined using an annual stack test.[39] Dr. Fox explains that "annual stack tests are staged events and are thus not adequate to assure that emission limits are met routinely under all operating conditions."[40] Since CEMS are available for NOx, ROG and CO, Dr. Fox recommends that CEMS be required to determine compliance with the proposed NOx, ROG and CO emission limits.[41] Dr. Fox points out that accurately verifying compliance with the NOx and

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[33] Carson Draft Title V Permit, pdf 47.
[34] Fox Comments, p. 8.
[35] DEIR, p. B-3-48.
[36] DEIR, Table 4.3-6.
[37] Fox Comments, p. 7.
[38] *Id.*
[39] Carson Draft Title V Permit, Condition D29.X1.
[40] Fox Comments, p. 8.
[41] *Id.*

ROG limits are particularly important because the Air District "is in serious nonattainment with ozone ambient air quality standards."[42]

D. The Proposed Permit Allows Emissions from the Refinery Flare No. 5 System (Process 21, System 6) that Are Not Evaluated in the DEIR

The proposed Title V permit adds the Alkylation Unit (Process 9, System 1) to the Refinery No. 5 Flare System.[43] The DEIR does not specifically disclose this addition; it merely mentions that "[p]art of the piping associated with unit modifications may include installation of new pressure relief valves that will tie into the various Refinery flare."[44]

The proposed Title V permit changes the emission limits for this flare system as follows:

- ROG: from 36 lbs/day to 48.7 lbs/day;
- CO: from 21 lbs/day to 243.33 lbs/day; and
- PM: from 106 lbs/day to 52.14 lbs/day.

According to Dr. Fox, the addition of the flare system would also increase NOx and SOx emissions.[45] The proposed permit modifications do not include any limits on NOx or SOx. Further, the DEIR does not include these emission increases.

Dr. Fox provides that the flare system increase in ROG emissions (12.7 lbs/day), when added to other Project increases and decreases in ROG emissions (found in DEIR Table 4.2-4), result in total ROG emissions of 61.8 lbs/day, which exceeds the Air District's ROG significance threshold of 55 lbs/day.[46]

E. The Proposed Permit Fails to Require All Necessary Conditions for the FCCU Shutdown

The proposed permit requires the shutdown of the FCCU equipment in Condition L341.X1. Dr. Fox points out that the proposed permit fails to include the removal of all supporting fugitive components or, in the alternative, fails to explain

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[42] *Id.*
[43] Draft Carson Title V Permit, pdf 45.
[44] DEIR, p. 2-46.
[45] Fox Comments, p. 9.
[46] *Id.*

how the components would be abandoned in place.[47] Dr. Fox explains that if the components are abandoned in place, the proposed permit must impose conditions that ensure "piping and components are maintained hydrocarbon free, either by blind flanging or by blind flanging and air-gapping."[48] If the permit does not contain these conditions, the DEIR must be revised to eliminate the assumed ROG reductions of 17.6 lbs/day from FCCU fugitive components.[49] If the reductions are eliminated, the total Project VOC emissions would increase to 67 lbs/day, which exceeds the Air District's ROG significance threshold of 55 lbs/day.[50]

IV. CONCLUSION

The Air District cannot issue the proposed Title V permit modifications for the Wilmington and Carson Operations. The proposed modifications for both the Wilmington and Carson Operations are inconsistent with many of the assumptions used in the DEIR to analyze the change in emissions from the Project, allow much higher emission increases of NOx than assumed in the DEIR, and fails to ensure that ambient air quality standards are not exceeded.

Sincerely,

Rachael Koss

Rachael Koss

REK:ric

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[47] *Id.*, p. 10.
[48] *Id.*
[49] *Id.*
[50] *Id.*

ATTACHMENT A

Phyllis Fox, Ph.D., PE
745 White Pine Ave.
Rockledge, FL 32955
321-626-6885

June 9, 2016

Rachael Koss
Adams Broadwell Joseph & Cardozo
601 Gateway Boulevard, Suite 1000
South San Francisco, CA 94080-7037

Dear Ms. Koss:

Per your request, I have reviewed the proposed Title V significant permit revisions for Tesoro Refining & Marketing Co. LLC, the Wilmington site (Facility ID #800436) and the Carson site (Facility ID #174655). I reviewed the separate draft Title V permit for each facility. As the draft permits do not have any official page numbers, my citations herein are to the pdf page number in each separate document. Thus, the first page of the draft Wilmington Title V permit is pdf 1, etc. and the first page of the draft Carson Title V permit is also pdf 1, etc.

The proposed modifications are based on changes described in the Draft Environmental Impact Report (DEIR) for the Tesoro Los Angeles Refinery Integration and Compliance Project (Project).[1] The specific modifications covered by this revision to the Title V permits represent only a tiny fraction of the changes described in the DEIR. They cover two heaters, Wilmington DCU heater H-100 and Carson No. 51 vacuum heater; the addition of various non-emitting equipment; modifications to the No. 5 Flare System; the shutdown of the Wilmington FCCU; and various fugitive emission sources.

Based on my review, summarized below, many of the proposed modifications allow much higher emissions than assumed in the DEIR.

[1] Environmental Audit, Inc., Tesoro Los Angeles Refinery Integration and Compliance Project Draft Environmental Impact Report, March 2016; Available at: http://www.aqmd.gov/home/library/documents-support-material/lead-agency-permit-projects.

Relationship to the DEIR

The DEIR evaluated the significance of the Project's operational emissions by calculating the change in daily emissions due to the Project, relative to the CEQA baseline in 2012 to 2013 as follows:[2]

Increase in Emission = Project Emissions (lb/day) - Baseline Emissions (lb/day)

The resulting emission changes for all Project components in pounds per day (lb/day) were compared to the SCAQMD's CEQA significance thresholds. This analysis is summarized in DEIR Table 4.2-4, which concluded that the Project would not result in any significant changes in emissions.

My review of the proposed Title V permit modifications indicates that they fail to assure the emission reductions assumed in the DEIR are achieved in practice and are enforceable.[3] The DEIR deviated from the standard emission increase calculation for heaters that experienced an increase in firing rate. For these heaters, the DEIR used the 98th percentile of the maximum emission rate as the baseline, rather than the daily average emissions in 2012 and 2013. See my DEIR Comment V.C. This artificially inflates the baseline, reducing the emission increases from increases in heater firing rates. The use of an inflated baseline means the emission changes ascribed to the Project are much lower than the actual emission changes that will occur as a result of the Project. The Title V permits must either be modified to assure that the assumed emission reductions are achieved in practice and are enforceable, or the DEIR must be modified to use the correct CEQA baseline and the Title V permit adjusted to ensure they are enforceable.

Wilmington Title V Permit Modifications

DCU H-100 Heater Duty Bump

The draft permit includes new conditions for this heater at: A63.XX (PM10, ROG, CO emission limits), A63.YY (NOx, SOx emission limits), A99.X (NOx emission limit startup and shutdown exemption), A195.XX (NOx rolling 24-hr average), A195.YY (SOx rolling 24-hr average), and D29.X (annual stack tests). The changes to the permit are reportedly based on SCAQMD Application 567439.

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[2] DEIR, Appx. B-3.

[3] DEIR, Appx. B-3 and Table 4.2-4.

Daily Criteria Pollutant Emissions

The Project increases the firing rate of heater H-100 by 20%, from the design heat release basis of 252 MMBtu/hr to the maximum heat release basis of 302.4 MMBtu/hr.[4] Increased firing rate increases emissions in direct proportion to the increase. However, the DEIR concluded that the increased firing rate would reduce emissions of all criteria pollutants except SOx by using the wrong baseline as explained in my comments on the DEIR. The emission reductions for heater H-100 claimed in the DEIR are as follows:[5]

- NOx: -171.03 lb/day
- CO: -5.14 lb/day
- PM10: -0.98 lb/day
- PM2.5: -0.98 lb/day
- VOC: -0.43 lb/day
- SOx: 86.69 lb/day

As explained in my comments on the DEIR, this counterintuitive result was obtained by using the 98th percentile of the maximum emissions for baseline emissions. However, this heater does not operate day in and day out at the 98th percentile value. The Title V permit must impose enforceable emission limits to assure that the reductions assumed in the DEIR are achieved in practice or the DEIR must be revised to correct the heater H-100 emission calculations using the correct CEQA baseline.

Further, the SCAQMD permit application for the subject modification to heater H-100's firing rate asserts that "Tesoro does not propose to increase the potentials to emit for this heater."[6] However, the proposed daily SOx limit of 250 lb/day and the proposed daily ROG limit of 35 lb/day are much higher than the potential to emit for heater H-100. The SOx PTE is 133 lb/day, compared to the proposed limit of 250 lb/day. The ROG PTE is 27 lb/day,[7] compared to the proposed limit of 35 lb/day. The 8 lb/day difference between the proposed ROG limit and the ROG PTE (35-27=8) is sufficient to tip the total Project ROG emissions of 49.09 lb/day over the CEQA significance threshold of 55 lb/day (49+8=57>55).[8] The DEIR, on the other hand, assumes the H-100 duty bump would reduce VOC emissions. Thus, it is evident that

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[4] DEIR, pp. 1-11/12.

[5] DEIR, Table 4.2-4.

[6] SCAQMD Application 567439, pdf 14.

[7] SCAQMD Application 567439, pdf 14.

[8] Revised ROG emissions = 49.09 + 35 – 27 = 57 lb/day, which is greater than 55 lb/day.

the proposed Title V permit limits do not assure that the emission assumptions in the DEIR are achieved.

Hourly NOx and SOx Limits

Condition S11.X sets an hourly limit on NOx of 18.4 lb/hr and an hourly limit on SOx of 14.08 lb/hr. These hourly emission limits are consistent with emissions used in the criteria pollutant air quality modelling for this heater.[9]

However, subsequent conditions in the draft Wilmington Title V permit weaken these hourly limits by specifying an averaging time that allows exceedances of the 1-hour limits to be averaged out. Condition A195.XX stipulates that compliance with the "hourly" NOx limit is based on a rolling 24-hour average. Condition A195.YY stipulates that compliance with the 1-hour SOx limit is also based on a rolling 24-hour average. This type of averaging convention allows much higher hourly emissions than were assumed in the criteria pollutant modelling, performed to demonstrate compliance with ambient air quality standards.[10]

A rolling 24-hour average smooths out emissions data and eliminates peak hourly values that would otherwise exceed the hourly values used in the air dispersion modeling analysis and limited in Condition S11.X. A rolling 24-hour average works like this. You take the first 24 hourly measurements (which may include values that exceed the hourly permit limit by a significant amount) and you average them all together for the first data point. You then drop out the first hourly value and average the next 24 hourly measurements. You continue in this manner, rolling through the entire data set, 24 hours at a time. If any of these 24-hour averages exceeds the hourly averages in Condition S11.X, it's a violation of the limit. This guts the intent of the 1-hour limit in Condition S11.X, which is essential to assure that hourly average ambient air quality standards are not exceeded.

This is particularly critical for NOx. The DEIR reported a total 1-hour average NOx concentration of 301.4 ug/m^3, compared to the State 1-hour ambient air quality standard of 339 ug/m^3.[11] The DEIR also reported a total 1-hour average NOx

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[9] The air quality modelling assumed: NOx: 2.7761364 g/s and SOx: 1.9145803 g/s. (Files: I&C - 1-8-hr (incl Cogen)_2011_NOX.dta and I&C - 1-8-hr (incl Cogen)_2011_SOX.dta). These are equivalent to (2.7761364 g/s)(60 s/min)(60 min/hr)(0.00220462 lb/g) = **22.03 lb/hr** for NOx and (1.9145803 g/s)(60 s/min)(60 min/hr)(0.00220462 lb/g) = **15.2 lb/hr** for SOx.

[10] DEIR, Table 4.2-12 and Table 10, p. B-3-23.

[11] DEIR, Table 4.2-12.

concentration of 184.9 ug/m^3 compared to the federal 1-hour ambient air quality standard of 188 ug/m^3.[12] These values are very close to the standards. If the modelled NOx concentration increased by just 3.2 ug/m^3,[13] from 38.6 ug/m^3 to 41.8 ug/m^3, the total NOx concentration would exceed the federal 1-hour NOx standard. This is readily foreseeable, given the 24-hour rolling averaging time. Thus, the proposed 24-hour averaging times allows potentially significant unmitigated ambient air quality impacts.

The rolling 24-hour averaging convention may also allow violations of the 1-hour SO_2 State (655 ug/m^3) and federal (196 ug/m^3) ambient air quality standards, especially the federal standard.

Therefore, the 24-hour rolling average conventions in Conditions A195XX and A195.YY should be eliminated.

Exceptions to Hourly NOx and SOx Limits

In addition to the generous averaging convention for hourly NOx and SOx limits, Condition A99.X at pdf 19 sets an exception to the new hourly NOx limit as follows:

The 18.40 lb/hr NOX emission limit(s) shall not apply during the heater startup, shutdowns or refractory dryout periods. For the purpose of this exception, each startup event shall not exceed 48 hours, not including refractory dryout period up to 48 additional hours and each shutown event shall not exceed 24 hours.

This exemption would allow unlimited increases in NOx emissions, sufficient to violate the state and federal 1-hour NOx ambient air quality standards and exceed the 55 lb/day NOx CEQA significance threshold for up to 48 hours at a time. A 10-fold increase, for example, is plausible as the SCR system, which typically reduces 90% of the NOx, would be off-line. This would be sufficient to violate the federal and state 1-hour NOx ambient air quality standards and exceed the CEQA NOx significance threshold.

The DEIR did not evaluate the impact of exemptions from hourly NOx limits on ambient air quality. This exemption results in a significant impact that was not disclosed in the DEIR. Further, automatic exemptions from permit limits during

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[12] DEIR, Table 10, p. B-3-23.

[13] 1-hr federal NOx NAAQS – total = 188-184.9 = 3.9 ug/m^3. The modeled 1-hour federal impact is 38.6 ug/m3. Thus, a 10% increase in the 1-hour NOx emission rate would exceed the federal 1-hour NOx NAAQS.

startups and shutdowns are no longer allowed.[14] The exemption in Condition A99.X should be eliminated.

Compliance

Compliance with the emission limits for PM10, ROG, and CO is determined using an annual stack test,[15] while compliance with NOx and SOx limits is based on the use of a SCAQMD-certified continuous emission monitoring system (CEMS). Annual stack tests are staged events and are thus not adequate to assure that emission limits are met routinely under all operating conditions. As CEMS are available for ROG, CO, and PM, they should be required to determine compliance with the proposed ROG, CO, and PM emission limits. It is particularly important to accurately verify compliance with the ROG limit as the SCAQMD is in serious nonattainment with ozone ambient air quality standards.

Carson Title V Permit Modifications

Carson No. 51 (D63) Vacuum Unit Heater

The Carson No. 51 Vacuum Unit Heater (D63) will be modified to increase its maximum permitted firing rate from 276.98 MMBtu/hr (98th percentile)[16] to 360 MMBtu/hr.[17] The increase in firing rate will increase emissions. The draft Title V permit sets new limits at A99.X1 (startup and shutdown exemption), A195.X1 (NOx 24 hr average), B61.8 (fuel gas H_2S limit), C1.X1 (heat input limit), and D29.X1 (test methods).

NOx, ROG, CO, and PM Emission Limits

The draft permit sets the following emission limits:[18]

- CO: 29.6 lb/MMSCF natural gas
- PM: 6.3 lbs/MMSCF natural gas
- ROG: 5.9 lbs/MMSCF natural gas
- NOx: 2.62 lbs/day natural gas

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[14] *Sierra Club v. Environmental Protection Agency*, 2008 WL 5264663 (D.C. Cir., Dec. 19, 2008).

[15] Wilmington Draft Title V Permit, pdf 18, Condition A63.XX.

[16] DEIR, p. B-3-56.

[17] DEIR, p. B-3-49 and Wilmington Draft Title V Permit, Condition C1.X1.

[18] Carson Draft Title V Permit, pdf 1.

Assuming the maximum firing rate of 360 MMBtu/hr and the higher heating value (HHV) of natural gas of 1050 MMBtu/MMSCF[19], these are equivalent to:

- CO: 244 lbs/day (DEIR:247 lbs/day)
- PM: 52 lbs/day (DEIR: 53 lbs/day)
- ROG: 48 lbs/day (DEIR: 50 lbs/day)
- NOx: 2.62 lbs/day (DEIR: 3.93 lbs/day)

These calculations indicate that the limits in lb/MMSCF natural gas are consistent with emissions assumed in the DEIR and the limits in lbs/day in Condition A63.3.[20]

The DEIR calculated the increase in emissions from the increased firing rate relative to the 98th percentile baseline, which is the wrong CEQA baseline. Thus, these limits allow a higher increase in emissions of these pollutants than assumed in the DEIR. However, it appears that the excess is much smaller than in the case of Wilmington heater H-100. These limits should thus be adjusted down to account for reductions relative to the 2012/2013 average CEQA baseline rather than the 98th percentile baseline.

However, Condition A99.X1 at pdf 46 exempts the 2.62 lbs/hr NOx limit during startups and shutdowns and allows the exemption to last up to 48 hours. Condition A195.X1 further specifies that the 2.62 lb/hr limit is based on a 24 hour average.

Thus, as explained for Wilmington heater H-100, the exemption and the 24 hour average allow much higher NOx emissions than assumed in the DEIR. These higher NOx emissions could cause violations of the State and federal 1-hour NOx ambient air quality standards as well as exceed the 55 lb/hr NOx significance threshold.

The DEIR did not evaluate the impact of exemptions from hourly NOx limits on ambient air quality or the impact of using a 24-hour average on compliance with the 1-hour NOx standards. Further, automatic exemptions from permit limits during startups and shutdowns are no longer allowed.[21] The exemption in Condition A99.X1 should be eliminated.

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[19] DEIR, Appx. B-3, p. B-3-48.

[20] Carson Draft Title V Permit, pdf 46: ROG <48.67 lb/day; CO <243.33 lbs/day; PM <52.14 lb/day.

[21] *Sierra Club v. Environmental Protection Agency*, 2008 WL 5264663 (D.C. Cir., Dec. 19, 2008).

SOx Emission Limit

The draft Carson Title V permit does not contain a limit on SOx in lb/day or lb/MMSCF. Rather, it sets a limit of 162 ppmv on H_2S in the fuel gas, averaged over 3 hours and excluding any vent gas from emergency malfunction, process upset or relief valve leakage.[22] This concentration limit is equivalent to 4.8 lb/hr[23] of H_2S. When the fuel gas is combusted, the H_2S is converted into SO_2. Thus, the proposed limit on H_2S concentration in the fuel gas is equivalent to an SO_2 emission rate limit of 9.6 lb/hr or 230 lb/day.

The DEIR, on the other hand, assumed the daily controlled SO_2 emissions from this heater are 4.94 lb/day[24] and the net increase in SO_2 due to the increased firing rate are 1.80 lb/day.[25] Thus, the Carson draft Title V permit fails to limit SO_2 emissions to those assumed in the DEIR.

The increase in SO_2 allowed from this single heater, combined with all other Project SO_2 emission increases and decreases as reported in DEIR Table 4.2-4, is 230 lb/day. This exceeds the SO_2 significance threshold of 150 lb/day.[26] Maximum daily SO_2 emissions could be even higher, as the 160 ppm H_2S limit is exempted under certain upset conditions. Thus, the draft Carson Title V Permit allows a significant air quality impact not disclosed in the DEIR.

Compliance

Compliance with the emission limits for PM, ROG, NOx, and CO is determined using an annual stack test.[27] Annual stack tests are staged events and are thus not adequate to assure that emission limits are met routinely under all operating conditions. As CEMS are available for NOx, ROG, CO and PM, they should be required to determine compliance with the proposed NOx, ROG, CO, and PM emission limits. It is particularly important to accurately verify compliance with the NOx and ROG limits as the SCAQMD is in serious nonattainment with ozone ambient air quality standards.

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[22] Draft Carson Title V Permit, pdf 47.

[23] Converting ppm H_2S to lb/hr H_2S: (160 ppm)(34 lb/lb-mole)(360 MMBtu/hr)(1,000,000 scf/MMsfc)/1050 MMBtu/MMscf]/[386.5 ft^3/lb-lb-mole x 10^6 ppm] = **4.83 lb/hr H_2S .**

[24] DEIR, pdf B-3-48.

[25] DEIR, Table 4.3-6.

[26] Total Project SO_2 emissions = <0.01 + 230 = 230 lb/day.

[27] Carson Draft Title V Permit, pdf 48, Condition D29.X1.

The draft Carson Title V permit does not explain how compliance with the H_2S limit will be determined. In fact, it eliminates Condition D90.16, which required monitoring for H_2S, but fails to replace this condition.

The draft Carson Title V permit should be modified to include a SOx limit consistent with DEIR assumptions and should require compliance using a SCAQMD-certified continuous emission monitoring system (CEMS).

Refinery Flare No. 5 System (Process 21, System 6)

The draft Carson Title V permit adds the Alkylation Unit (Process 9, System 1) to the Refinery No. 5 Flare System.[28] This addition is not specifically disclosed in the DEIR, beyond a general mention that "[p]art of the piping associated with unit modifications may include installation of new pressure relief values that will tie into the various Refinery flare."[29] The emission limits for this flare system are changed as follows:

- ROG: from 36 lb/day to 48.7 lb/day
- CO: from 21 lb/day to 243.33 lb/day
- PM: from 106 lb/day to 52.14 lb/day

The addition of the Alkylation Unit to the No. 5 Flare System would also increase NOx and SOx emissions, but the proposed permit modifications do not include any limits on NOx or SOx.

These emissions changes are not included in the DEIR. The increase in ROG emissions, 12.7 lb/day, when added to other Project increases and decreases in DEIR Table 4.2-4, results in total ROG emissions of 61.8 lb/day, which exceeds the ROG significance threshold of 55 lb/day. Further, the draft Carson Title V permit fails to set emission limits for this flare system on NOx or SOx or to include any compliance monitoring. The proposed reduction in PM emissions is unsupported and inconsistent with adding the Alkylation Unit to the No. 5 Flare System.

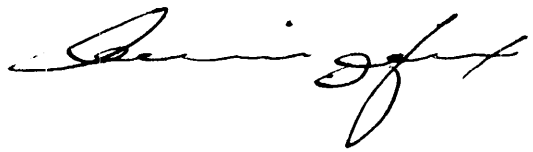
[28] Draft Carson Title V Permit, pdf 45.

[29] DEIR, p. 2-46.

FCCU Shutdown

The draft Carson Title V permit requires the shutdown of FCCU equipment in Condition L341.X1. This equipment list is incomplete. The DEIR also took credit for 17.6 lb/day of ROG emission reductions from FCCU fugitive components.[30]

The draft Carson Title V permit should be modified to require the removal of all supporting fugitive components in this condition or explain how it will be abandoned in place. If the latter, conditions must be imposed to assure piping and components are maintained hydrocarbon free, either by blind flanging or blind flanging and air-gapping.[31] Otherwise, the ROG reductions assumed in the DEIR should be eliminated. The elimination of these ROG reductions would increase total Project VOC emissions to 67 lb/day (49.09+17.6=66.69), which exceeds the ROG significance threshold of 55 lb/day.



Phyllis Fox, Ph.D., PE

[30] DEIR, Table 4.2-4.

[31] See SCAQMD Application 567649, pdf 512.

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Dr. Fox has over 40 years of experience in the field of environmental engineering, including air pollution control (BACT, BART, MACT, LAER, RACT), greenhouse gas emissions and control, cost effectiveness analyses, water quality and water supply investigations, hydrology, hazardous waste investigations, environmental permitting, nuisance investigations (odor, noise), environmental impact reports, CEQA/NEPA documentation, risk assessments, and litigation support.

EDUCATION

Ph.D. Environmental/Civil Engineering, University of California, Berkeley, 1980.
M.S. Environmental/Civil Engineering, University of California, Berkeley, 1975.
B.S. Physics (with high honors), University of Florida, Gainesville, 1971.

REGISTRATION

Registered Professional Engineer: Arizona (2001-2014: #36701; retired), California (2002-present; CH 6058), Florida (2001-present; #57886), Georgia (2002-2014; #PE027643; retired), Washington (2002-2014; #38692; retired), Wisconsin (2005-2014; #37595-006; retired)
Board Certified Environmental Engineer, American Academy of Environmental Engineers, Certified in Air Pollution Control (DEE #01-20014), 2002-present
Qualified Environmental Professional (QEP), Institute of Professional Environmental Practice (QEP #02-010007), 2001-present

PROFESSIONAL HISTORY

Environmental Management, Principal, 1981-present
Lawrence Berkeley National Laboratory, Principal Investigator, 1977-1981
University of California, Berkeley, Program Manager, 1976-1977
Bechtel, Inc., Engineer, 1971-1976, 1964-1966

PROFESSIONAL AFFILIATIONS

American Chemical Society (1981-2010)
Phi Beta Kappa (1970-present)
Sigma Pi Sigma (1970-present)

Who's Who Environmental Registry, PH Publishing, Fort Collins, CO, 1992.
Who's Who in the World, Marquis Who's Who, Inc., Chicago, IL, 11th Ed., p. 371, 1993-present.
Who's Who of American Women, Marquis Who's Who, Inc., Chicago, IL, 13th Ed., p. 264, 1984-present.
Who's Who in Science and Engineering, Marquis Who's Who, Inc., New Providence, NJ, 5th Ed., p. 414, 1999-present.
Who's Who in America, Marquis Who's Who, Inc., 59th Ed., 2005.
Guide to Specialists on Toxic Substances, World Environment Center, New York, NY, p. 80, 1980.
National Research Council Committee on Irrigation-Induced Water Quality Problems (Selenium), Subcommittee on Quality Control/Quality Assurance (1985-1990).
National Research Council Committee on Surface Mining and Reclamation, Subcommittee on Oil Shale (1978-80)

REPRESENTATIVE EXPERIENCE

Performed environmental and engineering investigations, as outlined below, for a wide range of industrial and commercial facilities including: petroleum refineries and upgrades thereto: reformulated fuels projects; refinery upgrades to process heavy sour crudes, including tar sands and light sweet crudes from the Eagle Ford and Bakken Formations; petroleum distribution terminals; coal, coke, and ore/mineral export terminals; LNG export, import, and storage terminals; crude-by-rail projects; shale oil plants; crude oil/condensate marine and rail terminals; coal gasification & liquefaction plants; conventional and thermally enhanced oil production; oil and gas production, including hydraulic fracking and acid stimulation treatments; underground storage tanks; pipelines; compressor stations; gasoline stations; landfills; railyards; hazardous waste treatment facilities; nuclear, hydroelectric, geothermal, wood, biomass, waste, tire-derived fuel, gas, oil, coke and coal-fired power plants; transmission lines; airports; hydrogen plants; petroleum coke calcining plants; coke plants; activated carbon manufacturing facilities; asphalt plants; cement plants; incinerators; flares; manufacturing facilities (e.g., semiconductors, electronic assembly, aerospace components, printed circuit boards, amusement park rides); lanthanide processing plants; ammonia plants; nitric acid plants; urea plants; food processing plants; almond hulling facilities; composting facilities; grain processing facilities; grain elevators; ethanol production facilities; soy bean oil extraction plants; biodiesel plants; paint formulation plants; wastewater treatment plants; marine terminals and ports; gas processing plants; steel mills; iron nugget production facilities; pig iron plant, based on blast furnace technology; direct reduced iron plant; acid regeneration facilities; railcar refinishing facility; battery manufacturing plants; pesticide manufacturing and repackaging facilities; pulp and paper mills; olefin plants; methanol plants; ethylene crackers; desalination plants; selective catalytic reduction (SCR) systems; selective noncatalytic reduction (SNCR) systems; halogen acid furnaces; contaminated

property redevelopment projects (e.g., Mission Bay, Southern Pacific Railyards, Moscone Center expansion, San Diego Padres Ballpark); residential developments; commercial office parks, campuses, and shopping centers; server farms; transportation plans; and a wide range of mines including sand and gravel, hard rock, limestone, nacholite, coal, molybdenum, gold, zinc, and oil shale.

EXPERT WITNESS/LITIGATION SUPPORT

- For the California Attorney General, assist in determining compliance with probation terms in the matter of People v. Chevron USA.
- For plaintiffs, assist in developing Petitioners' proof brief for National Parks Conservation Association et al v. U.S. EPA, Petition for Review of Final Administrative Action of the U.S. EPA, In the U.S. Court of Appeals for the Third Circuit, Docket No. 14-3147.
- For plaintiffs, expert witness in civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications (1997-2000) at the Cemex cement plant in Lyons, Colorado. Reviewed produced documents, prepared expert and rebuttal reports on PSD applicability based on NOx emission calculations for a collection of changes considered both individually and collectively. Deposed August 2011. *United States v. Cemex, Inc.*, In U.S. District Court for the District of Colorado (Civil Action No. 09-cv-00019-MSK-MEH). Case settled June 13, 2013.
- For plaintiffs, in civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications (1988 – 2000) at James De Young Units 3, 4, and 5. Reviewed produced documents, analyzed CEMS and EIA data, and prepared netting and BACT analyses for NOx, SO2, and PM10 (PSD case). Expert report February 24, 2010 and affidavit February 20, 2010. *Sierra Club v. City of Holland, et al.*, U.S. District Court, Western District of Michigan (Civil Action 1:08-cv-1183). Case settled. Consent Decree 1/19/14.
- For plaintiffs, in civil action alleging failure to obtain MACT permit, expert on potential to emit hydrogen chloride (HCl) from a new coal-fired boiler. Reviewed record, estimated HCl emissions, wrote expert report June 2010 and March 2013 (Cost to Install a Scrubber at the Lamar Repowering Project Pursuant to Case-by-Case MACT), deposed August 2010 and March 2013. *Wildearth Guardian et al. v. Lamar Utilities Board,* Civil Action No. 09-cv-02974, U.S. District Court, District of Colorado. Case settled August 2013.
- For plaintiffs, expert witness on permitting, emission calculations, and wastewater treatment for coal-to-gasoline plant. Reviewed produced documents. Assisted in preparation of comments on draft minor source permit. Wrote two affidavits on key issues in case. Presented direct and rebuttal testimony 10/27 - 10/28/10 on permit enforceability and failure to properly calculate potential to emit, including underestimate of flaring emissions and

omission of VOC and CO emissions from wastewater treatment, cooling tower, tank roof landings, and malfunctions. *Sierra Club, Ohio Valley Environmental Coalition, Coal River Mountain Watch, West Virginia Highlands Conservancy v. John Benedict, Director, Division of Air Quality, West Virginia Department of Environmental Protection and TransGas Development System, LLC*, Appeal No. 10-01-AQB. Virginia Air Quality Board remanded the permit on March 28, 2011 ordering reconsideration of potential to emit calculations, including: (1) support for assumed flare efficiency; (2) inclusion of startup, shutdown and malfunction emissions; and (3) inclusion of wastewater treatment emissions in potential to emit calculations.

- For plaintiffs, expert on BACT emission limits for gas-fired combined cycle power plant. Prepared declaration in support of CBE's Opposition to the United States' Motion for Entry of Proposed Amended Consent Decree. Assisted in settlement discussions. *U.S. EPA, Plaintiff, Communities for a Better Environment, Intervenor Plaintiff, v. Pacific Gas & Electric Company, et al.*, U.S. District Court, Northern District of California, San Francisco Division, Case No. C-09-4503 SI.
- Technical expert in confidential settlement discussions with large coal-fired utility on BACT control technology and emission limits for NOx, SO2, PM, PM2.5, and CO for new natural gas fired combined cycle and simple cycle turbines with oil backup. (July 2010). Case settled.
- For plaintiffs, expert witness in remedy phase of civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications (1998-99) at Gallagher Units 1 and 3. Reviewed produced documents, prepared expert and rebuttal reports on historic and current-day BACT for SO2, control costs, and excess emissions of SO2. Deposed 11/18/09. *United States et al. v. Cinergy, et al.*, In U.S. District Court for the Southern District of Indiana, Indianapolis Division, Civil Action No. IP99-1693 C-M/S. Settled 12/22/09.
- For plaintiffs, expert witness on MACT, BACT for NOx, and enforceability in an administrative appeal of draft state air permit issued for four 300-MW pet-coke-fired CFBs. Reviewed produced documents and prepared prefiled testimony. Deposed 10/8/09 and 11/9/09. Testified 11/10/09. *Application of Las Brisas Energy Center, LLC for State Air Quality Permit*; before the State Office of Administrative Hearings, Texas. Permit remanded 3/29/10 as LBEC failed to meet burden of proof on a number of issues including MACT. Texas Court of Appeals dismissed an appeal to reinstate the permit. The Texas Commission on Environmental Quality and Las Brisas Energy Center, LLC sought to overturn the Court of Appeals decision but moved to have their appeal dismissed in August 2013.
- For defense, expert witness in unlawful detainer case involving a gasoline station, minimart, and residential property with contamination from leaking underground storage tanks. Reviewed agency files and inspected site. Presented expert testimony on July 6, 2009, on

causes of, nature and extent of subsurface contamination. *A. Singh v. S. Assaedi,* in Contra Costa County Superior Court, CA. Settled August 2009.

- For plaintiffs, expert witness on netting and enforceability for refinery being upgraded to process tar sands crude. Reviewed produced documents. Prepared expert and rebuttal reports addressing use of emission factors for baseline, omitted sources including coker, flares, tank landings and cleaning, and enforceability. Deposed. *In the Matter of Objection to the Issuance of Significant Source Modification Permit No. 089-25484-00453 to BP Products North America Inc., Whiting Business Unit, Save the Dunes Council, Inc., Sierra Club., Inc., Hoosier Environmental Council et al., Petitioners, B. P. Products North American, Respondents/Permittee,* before the Indiana Office of Environmental Adjudication.
- For plaintiffs, expert witness on BACT, MACT, and enforceability in appeal of Title V permit issued to 600 MW coal-fired power plant burning Powder River Basin coal. Prepared technical comments on draft air permit. Reviewed record on appeal, drafted BACT, MACT, and enforceability pre-filed testimony. Drafted MACT and enforceability pre-filed rebuttal testimony. Deposed March 24, 2009. Testified June 10, 2009. *In Re: Southwestern Electric Power Company*, Arkansas Pollution Control and Ecology Commission, Consolidated Docket No. 08-006-P. Recommended Decision issued December 9, 2009 upholding issued permit. Commission adopted Recommended Decision January 22, 2010.
- For plaintiffs, expert witness in remedy phase of civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications (1989-1992) at Wabash Units 2, 3 and 5. Reviewed produced documents, prepared expert and rebuttal report on historic and current-day BACT for NOx and SO2, control costs, and excess emissions of NOx, SO2, and mercury. Deposed 10/21/08. *United States et al. v. Cinergy, et al.*, In U.S. District Court for the Southern District of Indiana, Indianapolis Division, Civil Action No. IP99-1693 C-M/S. Testified 2/3/09. Memorandum Opinion & Order 5-29-09 requiring shutdown of Wabash River Units 2, 3, 5 by September 30, 2009, run at baseline until shutdown, and permanently surrender SO2 emission allowances.
- For plaintiffs, expert witness in liability phase of civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for three historic modifications (1997-2001) at two portland cement plants involving three cement kilns. Reviewed produced documents, analyzed CEMS data covering subject period, prepared netting analysis for NOx, SO_2 and CO, and prepared expert and rebuttal reports. *United States v. Cemex California Cement,* In U.S. District Court for the Central District of California, Eastern Division, Case No. ED CV 07-00223-GW (JCRx), Settled 1/15/09.
- For intervenors Clean Wisconsin and Citizens Utility Board, prepared data requests, reviewed discovery and expert report. Prepared prefiled direct, rebuttal and surrebuttal testimony on cost to extend life of existing Oak Creek Units 5-8 and cost to address future regulatory requirements to determine whether to control or shutdown one or more of the units. Oral testimony 2/5/08. Application for a Certificate of Authority to Install Wet Flue

Gas Desulfurization and Selective Catalytic Reduction Facilities and Associated Equipment for Control of Sulfur Dioxide and Nitrogen Oxide Emissions at Oak Creek Power Plant Units 5, 6, 7 and 8, WPSC Docket No. 6630-CE-299.

- For plaintiffs, expert witness on alternatives analysis and BACT for NOx, SO2, total PM10, and sulfuric acid mist in appeal of PSD permit issued to 1200 MW coal fired power plant burning Powder River Basin and/or Central Appalachian coal (Longleaf). Assisted in drafting technical comments on NOx on draft permit. Prepared expert disclosure. Presented 8+ days of direct and rebuttal expert testimony. Attended all 21 days of evidentiary hearing from 9/5/07 – 10/30/07 assisting in all aspects of hearing. *Friends of the Chatahooche and Sierra Club v. Dr. Carol Couch, Director, Environmental Protection Division of Natural Resources Department, Respondent, and Longleaf Energy Associates, Intervener.* ALJ Final Decision 1/11/08 denying petition. ALJ Order vacated & remanded for further proceedings, Fulton County Superior Court, 6/30/08. Court of Appeals of GA remanded the case with directions that the ALJ's final decision be vacated to consider the evidence under the correct standard of review, July 9, 2009. The ALJ issued an opinion April 2, 2010 in favor of the applicant. Final permit issued April 2010.
- For plaintiffs, expert witness on diesel exhaust in inverse condemnation case in which Port expanded maritime operations into residential neighborhoods, subjecting plaintiffs to noise, light, and diesel fumes. Measured real-time diesel particulate concentrations from marine vessels and tug boats on plaintiffs' property. Reviewed documents, depositions, DVDs, and photographs provided by counsel. Deposed. Testified October 24, 2006. *Ann Chargin, Richard Hackett, Carolyn Hackett, et al. v. Stockton Port District*, Superior Court of California, County of San Joaquin, Stockton Branch, No. CV021015. Judge ruled for plaintiffs.
- For plaintiffs, expert witness on NOx emissions and BACT in case alleging failure to obtain necessary permits and install controls on gas-fired combined-cycle turbines. Prepared and reviewed (applicant analyses) of NOx emissions, BACT analyses (water injection, SCR, ultra low NOx burners), and cost-effectiveness analyses based on site visit, plant operating records, stack tests, CEMS data, and turbine and catalyst vendor design information. Participated in negotiations to scope out consent order. *United States v. Nevada Power.* Case settled June 2007, resulting in installation of dry low NOx burners (5 ppm NOx averaged over 1 hr) on four units and a separate solar array at a local business.
- For plaintiffs, expert witness in appeal of PSD permit issued to 850 MW coal fired boiler burning Powder River Basin coal (Iatan Unit 2) on BACT for particulate matter, sulfuric acid mist and opacity and emission calculations for alleged historic violations of PSD. Assisted in drafting technical comments, petition for review, discovery requests, and responses to discovery requests. Reviewed produced documents. Prepared expert report on BACT for particulate matter. Assisted with expert depositions. Deposed February 7, 8, 27, 28, 2007. *In Re PSD Construction Permit Issued to Great Plains Energy, Kansas City Power & Light – Iatan Generating Station, Sierra Club v. Missouri Department of Natural Resources, Great*

Plains Energy, and Kansas City Power & Light. Case settled March 27, 2007, providing offsets for over 6 million ton/yr of CO2 and lower NOx and SO_2 emission limits.

- For plaintiffs, expert witness in remedy phase of civil action relating to alleged violations of the Clean Air Act, Prevention of Significant Deterioration, for historic modifications of coal-fired boilers and associated equipment. Reviewed produced documents, prepared expert report on cost to retrofit 24 coal-fired power plants with scrubbers designed to remove 99% of the sulfur dioxide from flue gases. Prepared supplemental and expert report on cost estimates and BACT for SO2 for these 24 complaint units. Deposed 1/30/07 and 3/14/07. *United States and State of New York et al. v. American Electric Power*, In U.S. District Court for the Southern District of Ohio, Eastern Division, Consolidated Civil Action Nos. C2-99-1182 and C2-99-1250. Settlement announced 10/9/07.

- For plaintiffs, expert witness on BACT, enforceability, and alternatives analysis in appeal of PSD permit issued for a 270-MW pulverized coal fired boiler burning Powder River Basin coal (City Utilities Springfield Unit 2). Reviewed permitting file and assisted counsel draft petition and prepare and respond to interrogatories and document requests. Reviewed interrogatory responses and produced documents. Assisted with expert depositions. Deposed August 2005. Evidentiary hearings October 2005. *In the Matter of Linda Chipperfield and Sierra Club v. Missouri Department of Natural Resources.* Missouri Supreme Court denied review of adverse lower court rulings August 2007.

- For plaintiffs, expert witness in civil action relating to plume touchdowns at AEP's Gavin coal-fired power plant. Assisted counsel draft interrogatories and document requests. Reviewed responses to interrogatories and produced documents. Prepared expert report "Releases of Sulfuric Acid Mist from the Gavin Power Station." The report evaluates sulfuric acid mist releases to determine if AEP complied with the requirements of CERCLA Section 103(a) and EPCRA Section 304. This report also discusses the formation, chemistry, release characteristics, and abatement of sulfuric acid mist in support of the claim that these releases present an imminent and substantial endangerment to public health under Section 7002(a)(1)(B) of the Resource Conservation and Recovery Act ("RCRA"). *Citizens Against Pollution v. Ohio Power Company*, In the U.S. District Court for the Southern District of Ohio, Eastern Division, Civil Action No. 2-04-cv-371. Case settled 12-8-06.

- For petitioners, expert witness in contested case hearing on BACT, enforceability, and emission estimates for an air permit issued to a 500-MW supercritical Power River Basin coal-fired boiler (Weston Unit 4). Assisted counsel prepare comments on draft air permit and respond to and draft discovery. Reviewed produced file, deposed (7/05), and prepared expert report on BACT and enforceability. Evidentiary hearings September 2005. *In the Matter of an Air Pollution Control Construction Permit Issued to Wisconsin Public Service Corporation for the Construction and Operation of a 500 MW Pulverized Coal-fired Power Plant Known as Weston Unit 4 in Marathon County, Wisconsin*, Case No. IH-04-21. The Final Order, issued 2/10/06, lowered the NOx BACT limit from 0.07 lb/MMBtu to 0.06

lb/MMBtu based on a 30-day average, added a BACT SO2 control efficiency, and required a 0.0005% high efficiency drift eliminator as BACT for the cooling tower. The modified permit, including these provisions, was issued 3/28/07. Additional appeals in progress.

- For plaintiffs, adviser on technical issues related to Citizen Suit against U.S. EPA regarding failure to update New Source Performance Standards for petroleum refineries, 40 CFR 60, Subparts J, VV, and GGG. *Our Children's Earth Foundation and Sierra Club v. U.S. EPA et al.* Case settled July 2005. CD No. C 05-00094 CW, U.S. District Court, Northern District of California – Oakland Division. Proposed revisions to standards of performance for petroleum refineries published 72 FR 27178 (5/14/07).
- For interveners, reviewed proposed Consent Decree settling Clean Air Act violations due to historic modifications of boilers and associated equipment at two coal-fired power plants. In response to stay order, reviewed the record, selected one representative activity at each of seven generating units, and analyzed to identify CAA violations. Identified NSPS and NSR violations for NOx, SO_2, PM/PM10, and sulfuric acid mist. Summarized results in an expert report. *United States of America, and Michael A. Cox, Attorney General of the State of Michigan, ex rel. Michigan Department of Environmental Quality, Plaintiffs, and Clean Wisconsin, Sierra Club, and Citizens' Utility Board, Intervenors, v. Wisconsin Electric Power Company, Defendant*, U.S. District Court for the Eastern District of Wisconsin, Civil Action No. 2:03-CV-00371-CNC. Order issued 10-1-07 denying petition.
- For a coalition of Nevada labor organizations (ACE), reviewed preliminary determination to issue a Class I Air Quality Operating Permit to Construct and supporting files for a 250-MW pulverized coal-fired boiler (Newmont). Prepared about 100 pages of technical analyses and comments on BACT, MACT, emission calculations, and enforceability. Assisted counsel draft petition and reply brief appealing PSD permit to U.S. EPA Environmental Appeals Board (EAB). Order denying review issued 12/21/05. *In re Newmont Nevada Energy Investment, LLC, TS Power Plant*, PSD Appeal No. 05-04 (EAB 2005).
- For petitioners and plaintiffs, reviewed and prepared comments on air quality and hazardous waste based on negative declaration for refinery ultra low sulfur diesel project located in SCAQMD. Reviewed responses to comments and prepared responses. Prepared declaration and presented oral testimony before SCAQMD Hearing Board on exempt sources (cooling towers) and calculation of potential to emit under NSR. Petition for writ of mandate filed March 2005. Case remanded by Court of Appeals to trial court to direct SCAQMD to re-evaluate the potential environmental significance of NOx emissions resulting from the project in accordance with court's opinion. California Court of Appeals, Second Appellate Division, on December 18, 2007, affirmed in part (as to baseline) and denied in part. *Communities for a Better Environment v. South Coast Air Quality Management District and ConocoPhillips and Carlos Valdez et al v. South Coast Air Quality Management District and ConocoPhillips.* Certified for partial publication 1/16/08. Appellate Court opinion upheld by CA Supreme Court 3/15/10. *(2010) 48 Cal.4th 310.*

- For amici seeking to amend a proposed Consent Decree to settle alleged NSR violations at Chevron refineries, reviewed proposed settlement, related files, subject modifications, and emission calculations. Prepared declaration on emission reductions, identification of NSR and NSPS violations, and BACT/LAER for FCCUs, heaters and boilers, flares, and sulfur recovery plants. *U.S. et al. v. Chevron U.S.A.*, Northern District of California, Case No. C 03-04650. Memorandum and Order Entering Consent Decree issued June 2005. Case No. C 03-4650 CRB.
- For petitioners, prepared declaration on enforceability of periodic monitoring requirements, in response to EPA's revised interpretation of 40 CFR 70.6(c)(1). This revision limited additional monitoring required in Title V permits. 69 FR 3203 (Jan. 22, 2004). *Environmental Integrity Project et al. v. EPA* (U.S. Court of Appeals for the District of Columbia). Court ruled the Act requires all Title V permits to contain monitoring requirements to assure compliance. *Sierra Club v. EPA*, 536 F.3d 673 (D.C. Cir. 2008).
- For interveners in application for authority to construct a 500 MW supercritical coal-fired generating unit before the Wisconsin Public Service Commission, prepared pre-filed written direct and rebuttal testimony with oral cross examination and rebuttal on BACT and MACT (Weston 4). Prepared written comments on BACT, MACT, and enforceability on draft air permit for same facility.
- For property owners in Nevada, evaluated the environmental impacts of a 1,450-MW coal-fired power plant proposed in a rural area adjacent to the Black Rock Desert and Granite Range, including emission calculations, air quality modeling, comments on proposed use permit to collect preconstruction monitoring data, and coordination with agencies and other interested parties. Project cancelled.
- For environmental organizations, reviewed draft PSD permit for a 600-MW coal-fired power plant in West Virginia (Longview). Prepared comments on permit enforceability; coal washing; BACT for SO_2 and PM10; Hg MACT; and MACT for HCl, HF, non-Hg metallic HAPs, and enforceability. Assist plaintiffs draft petition appealing air permit. Retained as expert to develop testimony on MACT, BACT, offsets, enforceability. Participate in settlement discussions. Case settled July 2004.
- For petitioners, reviewed record produced in discovery and prepared affidavit on emissions of carbon monoxide and volatile organic compounds during startup of GE 7FA combustion turbines to successfully establish plaintiff standing. *Sierra Club et al. v. Georgia Power Company* (Northern District of Georgia).
- For building trades, reviewed air quality permitting action for 1500-MW coal-fired power plant before the Kentucky Department for Environmental Protection (Thoroughbred).
- For petitioners, expert witness in administrative appeal of the PSD/Title V permit issued to a 1500-MW coal-fired power plant. Reviewed over 60,000 pages of produced documents, prepared discovery index, identified and assembled plaintiff exhibits. Deposed. Assisted

counsel in drafting discovery requests, with over 30 depositions, witness cross examination, and brief drafting. Presented over 20 days of direct testimony, rebuttal and sur-rebuttal, with cross examination on BACT for NOx, SO_2, and PM/PM10; MACT for Hg and non-Hg metallic HAPs; emission estimates for purposes of Class I and II air modeling; risk assessment; and enforceability of permit limits. Evidentiary hearings from November 2003 to June 2004. *Sierra Club et al. v. Natural Resources & Environmental Protection Cabinet, Division of Air Quality and Thoroughbred Generating Company et al.* Hearing Officer Decision issued August 9, 2005 finding in favor of plaintiffs on counts as to risk, BACT (IGCC/CFB, NOx, SO_2, Hg, Be), single source, enforceability, and errors and omissions. Assist counsel draft exceptions. Cabinet Secretary issued Order April 11, 2006 denying Hearing Offer's report, except as to NOx BACT, Hg, 99% SO2 control and certain errors and omissions.

- For citizens group in Massachusetts, reviewed, commented on, and participated in permitting of pollution control retrofits of coal-fired power plant (Salem Harbor).
- Assisted citizens group and labor union challenge issuance of conditional use permit for a 317,000 ft^2 discount store in Honolulu without any environmental review. In support of a motion for preliminary injunction, prepared 7-page declaration addressing public health impacts of diesel exhaust from vehicles serving the Project. In preparation for trial, prepared 20-page preliminary expert report summarizing results of diesel exhaust and noise measurements at two big box retail stores in Honolulu, estimated diesel PM10 concentrations for Project using ISCST, prepared a cancer health risk assessment based on these analyses, and evaluated noise impacts.
- Assisted environmental organizations to challenge the DOE Finding of No Significant Impact (FONSI) for the Baja California Power and Sempra Energy Resources Cross-Border Transmissions Lines in the U.S. and four associated power plants located in Mexico (DOE EA-1391). Prepared 20-page declaration in support of motion for summary judgment addressing emissions, including CO_2 and NH_3, offsets, BACT, cumulative air quality impacts, alternative cooling systems, and water use and water quality impacts. Plaintiff's motion for summary judgment granted in part. U.S. District Court, Southern District decision concluded that the Environmental Assessment and FONSI violated NEPA and the APA due to their inadequate analysis of the potential controversy surrounding the project, water impacts, impacts from NH_3 and CO_2, alternatives, and cumulative impacts. *Border Power Plant Working Group v. Department of Energy and Bureau of Land Management*, Case No. 02-CV-513-IEG (POR) (May 2, 2003).
- For Sacramento school, reviewed draft air permit issued for diesel generator located across from playfield. Prepared comments on emission estimates, enforceability, BACT, and health impacts of diesel exhaust. Case settled. BUG trap installed on the diesel generator.
- Assisted unions in appeal of Title V permit issued by BAAQMD to carbon plant that manufactured coke. Reviewed District files, identified historic modifications that should have triggered PSD review, and prepared technical comments on Title V permit. Reviewed

responses to comments and assisted counsel draft appeal to BAAQMD hearing board, opening brief, motion to strike, and rebuttal brief. Case settled.

- Assisted California Central Coast city obtain controls on a proposed new city that would straddle the Ventura-Los Angeles County boundary. Reviewed several environmental impact reports, prepared an air quality analysis, a diesel exhaust health risk assessment, and detailed review comments. Governor intervened and State dedicated the land for conservation purposes April 2004.
- Assisted Central California city to obtain controls on large alluvial sand quarry and asphalt plant proposing a modernization. Prepared comments on Negative Declaration on air quality, public health, noise, and traffic. Evaluated process flow diagrams and engineering reports to determine whether proposed changes increased plant capacity or substantially modified plant operations. Prepared comments on application for categorical exemption from CEQA. Presented testimony to County Board of Supervisors. Developed controls to mitigate impacts. Assisted counsel draft Petition for Writ. Case settled June 2002. Substantial improvements in plant operations were obtained including cap on throughput, dust control measures, asphalt plant loadout enclosure, and restrictions on truck routes.
- Assisted oil companies on the California Central Coast in defending class action citizen's lawsuit alleging health effects due to emissions from gas processing plant and leaking underground storage tanks. Reviewed regulatory and other files and advised counsel on merits of case. Case settled November 2001.
- Assisted oil company on the California Central Coast in defending property damage claims arising out of a historic oil spill. Reviewed site investigation reports, pump tests, leachability studies, and health risk assessments, participated in design of additional site characterization studies to assess health impacts, and advised counsel on merits of case. Prepare health risk assessment.
- Assisted unions in appeal of Initial Study/Negative Declaration ("IS/ND") for an MTBE phaseout project at a Bay Area refinery. Reviewed IS/ND and supporting agency permitting files and prepared technical comments on air quality, groundwater, and public health impacts. Reviewed responses to comments and final IS/ND and ATC permits and assisted counsel to draft petitions and briefs appealing decision to Air District Hearing Board. Presented sworn direct and rebuttal testimony with cross examination on groundwater impacts of ethanol spills on hydrocarbon contamination at refinery. Hearing Board ruled 5 to 0 in favor of appellants, remanding ATC to district to prepare an EIR.
- Assisted Florida cities in challenging the use of diesel and proposed BACT determinations in prevention of significant deterioration (PSD) permits issued to two 510-MW simple cycle peaking electric generating facilities and one 1,080-MW simple cycle/combined cycle facility. Reviewed permit applications, draft permits, and FDEP engineering evaluations, assisted counsel in drafting petitions and responding to discovery. Participated in settlement discussions. Cases settled or applications withdrawn.

- Assisted large California city in federal lawsuit alleging peaker power plant was violating its federal permit. Reviewed permit file and applicant's engineering and cost feasibility study to reduce emissions through retrofit controls. Advised counsel on feasible and cost-effective NOx, SOx, and PM10 controls for several 1960s diesel-fired Pratt and Whitney peaker turbines. Case settled.
- Assisted coalition of Georgia environmental groups in evaluating BACT determinations and permit conditions in PSD permits issued to several large natural gas-fired simple cycle and combined-cycle power plants. Prepared technical comments on draft PSD permits on BACT, enforceability of limits, and toxic emissions. Reviewed responses to comments, advised counsel on merits of cases, participated in settlement discussions, presented oral and written testimony in adjudicatory hearings, and provided technical assistance as required. Cases settled or won at trial.
- Assisted construction unions in review of air quality permitting actions before the Indiana Department of Environmental Management ("IDEM") for several natural gas-fired simple cycle peaker and combined cycle power plants.
- Assisted coalition of towns and environmental groups in challenging air permits issued to 523 MW dual fuel (natural gas and distillate) combined-cycle power plant in Connecticut. Prepared technical comments on draft permits and 60 pages of written testimony addressing emission estimates, startup/shutdown issues, BACT/LAER analyses, and toxic air emissions. Presented testimony in adjudicatory administrative hearings before the Connecticut Department of Environmental Protection in June 2001 and December 2001.
- Assisted various coalitions of unions, citizens groups, cities, public agencies, and developers in licensing and permitting of over 110 coal, gas, oil, biomass, and pet coke-fired power plants generating over 75,000 MW of electricity. These included base-load, combined cycle, simple cycle, and peaker power plants in Alaska, Arizona, Arkansas, California, Colorado, Georgia, Florida, Illinois, Indiana, Kentucky, Michigan, Missouri, Ohio, Oklahoma, Oregon, Texas, West Virginia, Wisconsin, and elsewhere. Prepared analyses of and comments on applications for certification, preliminary and final staff assessments, and various air, water, wastewater, and solid waste permits issued by local agencies. Presented written and oral testimony before various administrative bodies on hazards of ammonia use and transportation, health effects of air emissions, contaminated property issues, BACT/LAER issues related to SCR and SCONOx, criteria and toxic pollutant emission estimates, MACT analyses, air quality modeling, water supply and water quality issues, and methods to reduce water use, including dry cooling, parallel dry-wet cooling, hybrid cooling, and zero liquid discharge systems.
- Assisted unions, cities, and neighborhood associations in challenging an EIR issued for the proposed expansion of the Oakland Airport. Reviewed two draft EIRs and prepared a health risk assessment and extensive technical comments on air quality and public health impacts. The California Court of Appeals, First Appellate District, ruled in favor of appellants and

plaintiffs, concluding that the EIR "2) erred in using outdated information in assessing the emission of toxic air contaminants (TACs) from jet aircraft; 3) failed to support its decision not to evaluate the health risks associated with the emission of TACs with meaningful analysis," thus accepting my technical arguments and requiring the Port to prepare a new EIR. See *Berkeley Keep Jets Over the Bay Committee, City of San Leandro, and City of Alameda et al. v. Board of Port Commissioners* (August 30, 2001) 111 Cal.Rptr.2d 598.

- Assisted lessor of former gas station with leaking underground storage tanks and TCE contamination from adjacent property. Lessor held option to purchase, which was forfeited based on misrepresentation by remediation contractor as to nature and extent of contamination. Remediation contractor purchased property. Reviewed regulatory agency files and advised counsel on merits of case. Case not filed.
- Advised counsel on merits of several pending actions, including a Proposition 65 case involving groundwater contamination at an explosives manufacturing firm and two former gas stations with leaking underground storage tanks.
- Assisted defendant foundry in Oakland in a lawsuit brought by neighbors alleging property contamination, nuisance, trespass, smoke, and health effects from foundry operation. Inspected and sampled plaintiff's property. Advised counsel on merits of case. Case settled.
- Assisted business owner facing eminent domain eviction. Prepared technical comments on a negative declaration for soil contamination and public health risks from air emissions from a proposed redevelopment project in San Francisco in support of a CEQA lawsuit. Case settled.
- Assisted neighborhood association representing residents living downwind of a Berkeley asphalt plant in separate nuisance and CEQA lawsuits. Prepared technical comments on air quality, odor, and noise impacts, presented testimony at commission and council meetings, participated in community workshops, and participated in settlement discussions. Cases settled. Asphalt plant was upgraded to include air emission and noise controls, including vapor collection system at truck loading station, enclosures for noisy equipment, and improved housekeeping.
- Assisted a Fortune 500 residential home builder in claims alleging health effects from faulty installation of gas appliances. Conducted indoor air quality study, advised counsel on merits of case, and participated in discussions with plaintiffs. Case settled.
- Assisted property owners in Silicon Valley in lawsuit to recover remediation costs from insurer for large TCE plume originating from a manufacturing facility. Conducted investigations to demonstrate sudden and accidental release of TCE, including groundwater modeling, development of method to date spill, preparation of chemical inventory, investigation of historical waste disposal practices and standards, and on-site sewer and storm drainage inspections and sampling. Prepared declaration in opposition to motion for summary judgment. Case settled.

- Assisted residents in east Oakland downwind of a former battery plant in class action lawsuit alleging property contamination from lead emissions. Conducted historical research and dry deposition modeling that substantiated claim. Participated in mediation at JAMS. Case settled.
- Assisted property owners in West Oakland who purchased a former gas station that had leaking underground storage tanks and groundwater contamination. Reviewed agency files and advised counsel on merits of case. Prepared declaration in opposition to summary judgment. Prepared cost estimate to remediate site. Participated in settlement discussions. Case settled.
- Consultant to counsel representing plaintiffs in two Clean Water Act lawsuits involving selenium discharges into San Francisco Bay from refineries. Reviewed files and advised counsel on merits of case. Prepared interrogatory and discovery questions, assisted in deposing opposing experts, and reviewed and interpreted treatability and other technical studies. Judge ruled in favor of plaintiffs.
- Assisted oil company in a complaint filed by a resident of a small California beach community alleging that discharges of tank farm rinse water into the sanitary sewer system caused hydrogen sulfide gas to infiltrate residence, sending occupants to hospital. Inspected accident site, interviewed parties to the event, and reviewed extensive agency files related to incident. Used chemical analysis, field simulations, mass balance calculations, sewer hydraulic simulations with SWMM44, atmospheric dispersion modeling with SCREEN3, odor analyses, and risk assessment calculations to demonstrate that the incident was caused by a faulty drain trap and inadequate slope of sewer lateral on resident's property. Prepared a detailed technical report summarizing these studies. Case settled.
- Assisted large West Coast city in suit alleging that leaking underground storage tanks on city property had damaged the waterproofing on downgradient building, causing leaks in an underground parking structure. Reviewed subsurface hydrogeologic investigations and evaluated studies conducted by others documenting leakage from underground diesel and gasoline tanks. Inspected, tested, and evaluated waterproofing on subsurface parking structure. Waterproofing was substandard. Case settled.
- Assisted residents downwind of gravel mine and asphalt plant in Siskiyou County, California, in suit to obtain CEQA review of air permitting action. Prepared two declarations analyzing air quality and public health impacts. Judge ruled in favor of plaintiffs, closing mine and asphalt plant.
- Assisted defendant oil company on the California Central Coast in class action lawsuit alleging property damage and health effects from subsurface petroleum contamination. Reviewed documents, prepared risk calculations, and advised counsel on merits of case. Participated in settlement discussions. Case settled.

- Assisted defendant oil company in class action lawsuit alleging health impacts from remediation of petroleum contaminated site on California Central Coast. Reviewed documents, designed and conducted monitoring program, and participated in settlement discussions. Case settled.
- Consultant to attorneys representing irrigation districts and municipal water districts to evaluate a potential challenge of USFWS actions under CVPIA section 3406(b)(2). Reviewed agency files and collected and analyzed hydrology, water quality, and fishery data. Advised counsel on merits of case. Case not filed.
- Assisted residents downwind of a Carson refinery in class action lawsuit involving soil and groundwater contamination, nuisance, property damage, and health effects from air emissions. Reviewed files and provided advise on contaminated soil and groundwater, toxic emissions, and health risks. Prepared declaration on refinery fugitive emissions. Prepared deposition questions and reviewed deposition transcripts on air quality, soil contamination, odors, and health impacts. Case settled.
- Assisted residents downwind of a Contra Costa refinery who were affected by an accidental release of naphtha. Characterized spilled naphtha, estimated emissions, and modeled ambient concentrations of hydrocarbons and sulfur compounds. Deposed. Presented testimony in binding arbitration at JAMS. Judge found in favor of plaintiffs.
- Assisted residents downwind of Contra Costa County refinery in class action lawsuit alleging property damage, nuisance, and health effects from several large accidents as well as routine operations. Reviewed files and prepared analyses of environmental impacts. Prepared declarations, deposed, and presented testimony before jury in one trial and judge in second. Case settled.
- Assisted business owner claiming damages from dust, noise, and vibration during a sewer construction project in San Francisco. Reviewed agency files and PM10 monitoring data and advised counsel on merits of case. Case settled.
- Assisted residents downwind of Contra Costa County refinery in class action lawsuit alleging property damage, nuisance, and health effects. Prepared declaration in opposition to summary judgment, deposed, and presented expert testimony on accidental releases, odor, and nuisance before jury. Case thrown out by judge, but reversed on appeal and not retried.
- Presented testimony in small claims court on behalf of residents claiming health effects from hydrogen sulfide from flaring emissions triggered by a power outage at a Contra Costa County refinery. Analyzed meteorological and air quality data and evaluated potential health risks of exposure to low concentrations of hydrogen sulfide. Judge awarded damages to plaintiffs.
- Assisted construction unions in challenging PSD permit for an Indiana steel mill. Prepared technical comments on draft PSD permit, drafted 70-page appeal of agency permit action to

the Environmental Appeals Board challenging permit based on faulty BACT analysis for electric arc furnace and reheat furnace and faulty permit conditions, among others, and drafted briefs responding to four parties. EPA Region V and the EPA General Counsel intervened as amici, supporting petitioners. EAB ruled in favor of petitioners, remanding permit to IDEM on three key issues, including BACT for the reheat furnace and lead emissions from the EAF. Drafted motion to reconsider three issues. Prepared 69 pages of technical comments on revised draft PSD permit. Drafted second EAB appeal addressing lead emissions from the EAF and BACT for reheat furnace based on European experience with SCR/SNCR. Case settled. Permit was substantially improved. See *In re: Steel Dynamics, Inc.*, PSD Appeal Nos. 99-4 & 99-5 (EAB June 22, 2000).

- Assisted defendant urea manufacturer in Alaska in negotiations with USEPA to seek relief from penalties for alleged violations of the Clean Air Act. Reviewed and evaluated regulatory files and monitoring data, prepared technical analysis demonstrating that permit limits were not violated, and participated in negotiations with EPA to dismiss action. Fines were substantially reduced and case closed.
- Assisted construction unions in challenging PSD permitting action for an Indiana grain mill. Prepared technical comments on draft PSD permit and assisted counsel draft appeal of agency permit action to the Environmental Appeals Board challenging permit based on faulty BACT analyses for heaters and boilers and faulty permit conditions, among others. Case settled.
- As part of a consent decree settling a CEQA lawsuit, assisted neighbors of a large west coast port in negotiations with port authority to secure mitigation for air quality impacts. Prepared technical comments on mobile source air quality impacts and mitigation and negotiated a $9 million CEQA mitigation package. Represented neighbors on technical advisory committee established by port to implement the air quality mitigation program. Program successfully implemented.
- Assisted construction unions in challenging permitting action for a California hazardous waste incinerator. Prepared technical comments on draft permit, assisted counsel prepare appeal of EPA permit to the Environmental Appeals Board. Participated in settlement discussions on technical issues with applicant and EPA Region 9. Case settled.
- Assisted environmental group in challenging DTSC Negative Declaration on a hazardous waste treatment facility. Prepared technical comments on risk of upset, water, and health risks. Writ of mandamus issued.
- Assisted several neighborhood associations and cities impacted by quarries, asphalt plants, and cement plants in Alameda, Shasta, Sonoma, and Mendocino counties in obtaining mitigations for dust, air quality, public health, traffic, and noise impacts from facility operations and proposed expansions.

- For over 100 industrial facilities, commercial/campus, and redevelopment projects, developed the record in preparation for CEQA and NEPA lawsuits. Prepared technical comments on hazardous materials, solid wastes, public utilities, noise, worker safety, air quality, public health, water resources, water quality, traffic, and risk of upset sections of EIRs, EISs, FONSIs, initial studies, and negative declarations. Assisted counsel in drafting petitions and briefs and prepared declarations.
- For several large commercial development projects and airports, assisted applicant and counsel prepare defensible CEQA documents, respond to comments, and identify and evaluate "all feasible" mitigation to avoid CEQA challenges. This work included developing mitigation programs to reduce traffic-related air quality impacts based on energy conservation programs, solar, low-emission vehicles, alternative fuels, exhaust treatments, and transportation management associations.

SITE INVESTIGATION/REMEDIATION/CLOSURE

- Technical manager and principal engineer for characterization, remediation, and closure of waste management units at former Colorado oil shale plant. Constituents of concern included BTEX, As, 1,1,1-TCA, and TPH. Completed groundwater monitoring programs, site assessments, work plans, and closure plans for seven process water holding ponds, a refinery sewer system, and processed shale disposal area. Managed design and construction of groundwater treatment system and removal actions and obtained clean closure.
- Principal engineer for characterization, remediation, and closure of process water ponds at a former lanthanide processing plant in Colorado. Designed and implemented groundwater monitoring program and site assessments and prepared closure plan.
- Advised the city of Sacramento on redevelopment of two former railyards. Reviewed work plans, site investigations, risk assessment, RAPS, RI/FSs, and CEQA documents. Participated in the development of mitigation strategies to protect construction and utility workers and the public during remediation, redevelopment, and use of the site, including buffer zones, subslab venting, rail berm containment structure, and an environmental oversight plan.
- Provided technical support for the investigation of a former sanitary landfill that was redeveloped as single family homes. Reviewed and/or prepared portions of numerous documents, including health risk assessments, preliminary endangerment assessments, site investigation reports, work plans, and RI/FSs. Historical research to identify historic waste disposal practices to prepare a preliminary endangerment assessment. Acquired, reviewed, and analyzed the files of 18 federal, state, and local agencies, three sets of construction field notes, analyzed 21 aerial photographs and interviewed 14 individuals associated with operation of former landfill. Assisted counsel in defending lawsuit brought by residents

alleging health impacts and diminution of property value due to residual contamination. Prepared summary reports.

- Technical oversight of characterization and remediation of a nitrate plume at an explosives manufacturing facility in Lincoln, CA. Provided interface between owners and consultants. Reviewed site assessments, work plans, closure plans, and RI/FSs.
- Consultant to owner of large western molybdenum mine proposed for NPL listing. Participated in negotiations to scope out consent order and develop scope of work. Participated in studies to determine premining groundwater background to evaluate applicability of water quality standards. Served on technical committees to develop alternatives to mitigate impacts and close the facility, including resloping and grading, various thickness and types of covers, and reclamation. This work included developing and evaluating methods to control surface runoff and erosion, mitigate impacts of acid rock drainage on surface and ground waters, and stabilize nine waste rock piles containing 328 million tons of pyrite-rich, mixed volcanic waste rock (andesites, rhyolite, tuff). Evaluated stability of waste rock piles. Represented client in hearings and meetings with state and federal oversight agencies.

REGULATORY (PARTIAL LIST)

- In April 2016, prepared supplemental comments on Valero Benicia Crude by Rail Project, focused on on-site impacts and impacts at the unloading terminal, in response to request for a stay to appeal Planning Commission decision.
- In February 2016, prepared comments on Final Environmental Impact Report, Santa Maria Rail Spur Project.
- In February 2016, prepared comments on Final Environmental Impact Report, Valero Benicia Crude by Rail Project.
- In January 2016, prepared comments on Draft Programmatic Environmental Impact Report for the Southern California Association of Government's (SCAG) 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy.
- In November 2015, prepared comments on Final Environmental Impact Report for Revisions to the Kern County Zoning Ordinance – 2015(C) (Focused on Oil and Gas Local Permitting), November 2015.
- In October 2015, prepared comments on Revised Draft Environmental Report, Valero Benicia Crude by Rail Project.
- In September 2015, prepared report, "Environmental, Health and Safety Impacts of the Proposed Oakland Bulk and Oversized Terminal, and presented oral testimony on September 21, 2015 before Oakland City Council on behalf of the Sierra Club.

- In September 2015, prepared comments on revisions to two chapters of EPA's Air Pollution Control Cost Manual: Docket ID No. EPA-HQ-OAR-2015-0341.
- In June 2015, prepared comments on DEIR for the CalAm Monterey Peninsula Water Supply Project.
- In April 2015, prepared comments on proposed Title V Operating Permit Revision and Prevention of Significant Deterioration Permit for Arizona Public Service's Ocotillo Power Plant Modernization Project (5 GE LMS100 105-MW simple cycle turbines operated as peakers), in Tempe, Arizona.
- In March 2015, prepared "Comments on Proposed Title V Air Permit, Yuhuang Chemical Inc. Methanol Plant, St. James, Louisiana".
- In January 2015, prepared cost effectiveness analysis for SCR for a 500-MW coal fire power plant, to address unpermitted upgrades in 2000.
- In January 2015, prepared comments on Revised Final Environmental Impact Report for the Phillips 66 Propane Recovery Project.
- In December 2014, prepared "Report on Bakersfield Crude Terminal Permits to Operate." In response, the U.S. EPA cited the Terminal for 10 violations of the Clean Air Act.
- In December 2014, prepared comments on Revised Draft Environmental Impact Report for the Phillips 66 Propane Recovery Project.
- In November 2014, prepared comments on Revised Draft Environmental Impact Report for Phillips 66 Rail Spur Extension Project and Crude Unloading Project, Santa Maria, CA to allow the import of tar sands crudes.
- In November 2014, prepared comments on Draft Environmental Impact Report for Phillips 66 Ultra Low Sulfur Diesel Project, responding to the California Supreme Court Decision, *Communities for a Better Environment v. South Coast Air Quality Management Dist. (2010) 48 Cal.4th 310.*
- In November 2014, prepared comments on Draft Environmental Impact Report for the Tesoro Avon Marine Oil Terminal Lease Consideration.
- In October 2014, prepared: "Report on Hydrogen Cyanide Emissions from Fluid Catalytic Cracking Units", pursuant to the Petroleum Refinery Sector Risk and Technology Review and New Source Performance Standards, 79 FR 36880.
- In October 2014, prepared technical comments on Final Environmental Impact Reports for Alon Bakersfield Crude Flexibility Project to build a rail terminal to allow the import/export of tar sands and Bakken crude oils and to upgrade an existing refinery to allow it to process a wide range of crudes.

- In October 2014, prepared technical comments on the Title V Permit Renewal and three De Minimus Significant Revisions for the Tesoro Logistics Marine Terminal in the SCAQMD.
- In August 2014, for EPA Region 6, prepared technical report on costing methods for upgrades to existing scrubbers at coal-fired power plants.
- In July 2014, prepared technical comments on Draft Final Environmental Impact Reports for Alon Bakersfield Crude Flexibility Project to build a rail terminal to allow the import/export of tar sands and Bakken crude oils and to upgrade an existing refinery to allow it to process a wide range of crudes.
- In June 2014, prepared technical report on Initial Study and Draft Negative Declaration for the Tesoro Logistics Storage Tank Replacement and Modification Project.
- In May 2014, prepared technical comments on Intent to Approve a new refinery and petroleum transloading operation in Utah.
- In March and April 2014, prepared declarations on air permits issued for two crude-by-rail terminals in California, modified to switch from importing ethanol to importing Bakken crude oils by rail and transferring to tanker cars. Permits were issued without undergoing CEQA review. One permit was upheld by the San Francisco Superior Court as statute of limitations had run. The Sacramento Air Quality Management District withdrew the second one due to failure to require BACT and conduct CEQA review.
- In March 2014, prepared technical report on Negative Declaration for a proposed modification of the air permit for a bulk petroleum and storage terminal to the allow the import of tar sands and Bakken crude oil by rail and its export by barge, under the New York State Environmental Quality Review Act (SEQRA).
- In February 2014, prepared technical report on proposed modification of air permit for midwest refinery upgrade/expansion to process tar sands crudes.
- In January 2014, prepared cost estimates to capture, transport, and use CO2 in enhanced oil recovery, from the Freeport LNG project based on both Selexol and Amine systems.
- In January 2014, prepared technical report on Draft Environmental Impact Report for Phillips 66 Rail Spur Extension Project, Santa Maria, CA. Comments addressed project description (piecemealing, crude slate), risk of upset analyses, mitigation measures, alternative analyses and cumulative impacts.
- In November 2013, prepared technical report on3333 the Phillips 66 Propane Recovery Project, Rodeo, CA. Comments addressed project description (piecemealing, crude slate) and air quality impacts.
- In September 2013, prepared technical report on the Draft Authority to Construct Permit for the Casa Diablo IV Geothermal Development Project Environmental Impact Report and Declaration in Support of Appeal and Petition for Stay, U.S. Department of the Interior,

Board of Land Appeals, Appeal of Decision Record for the Casa Diablo IV Geothermal Development Project.

- In September 2013, prepared technical report on Effluent Limitation Guidelines for Best Available Technology Economically Available (BAT) for Bottom Ash Transport Waters from Coal-Fired Power Plants in the Steam Electric Power Generating Point Source Category.
- In July 2013, prepared technical report on Initial Study/Mitigated Negative Declaration for the Valero Crude by Rail Project, Benicia, California, Use Permit Application 12PLN-00063.
- In July 2013, prepared technical report on fugitive particulate matter emissions from coal train staging at the proposed Coyote Island Terminal, Oregon, for draft Permit No. 25-0015-ST-01.
- In July 2013, prepared technical comments on air quality impacts of the Finger Lakes LPG Storage Facility as reported in various Environmental Impact Statements.
- In July 2013, prepared technical comments on proposed Greenhouse Gas PSD Permit for the Celanese Clear Lake Plant, including cost analysis of CO2 capture, transport, and sequestration.
- In June/July 2013, prepared technical comments on proposed Draft PSD Preconstruction Permit for Greenhouse Gas Emission for the ExxonMobil Chemical Company Baytown Olefins Plant, including cost analysis of CO2 capture, transport, and sequestration.
- In June 2013, prepared technical report on a Mitigated Negative Declaration for a new rail terminal at the Valero Benicia Refinery to import increased amounts of "North American" crudes. Comments addressed air quality impacts of refining increased amounts of tar sands crudes.
- In June 2013, prepared technical report on Draft Environmental Impact Report for the California Ethanol and Power Imperial Valley 1 Project.
- In May 2013, prepared comments on draft PSD permit for major expansion of midwest refinery to process 100% tar sands crudes, including a complex netting analysis involving debottlenecking, piecemealing, and BACT analyses.
- In April 2013, prepared technical report on the Draft Supplemental Environmental Impact Statement (DSEIS) for the Keystone XL Pipeline on air quality impacts from refining increased amount of tar sands crudes at Refineries in PADD 3.
- In October 2012, prepared technical report on the Environmental Review for the Coyote Island Terminal Dock at the Port of Morrow on fugitive particulate matter emissions.
- In October 2012-October 2014, review and evaluate Flint Hills West Application for an expansion/modification for increased (Texas, Eagle Ford Shale) crude processing and related modification, including netting and BACT analysis. Assist in settlement discussions.

- In February 2012, prepared comments on BART analysis in PA Regional Haze SIP, 77 FR 3984 (Jan. 26, 2012). On Sept. 29, 2015, a federal appeals court overturned the U.S. EPA's approval of this plan, based in part on my comments, concluding "..we will vacate the 2014 Final Rule to the extent it approved Pennsylvania's source-specific BART analysis and remand to the EPA for further proceedings consistent with this Opinion." Nat'l Parks Conservation Assoc. v. EPA, 3d Cir., No. 14-3147, 9/19/15.
- Prepared cost analyses and comments on New York's proposed BART determinations for NOx, SO2, and PM and EPA's proposed approval of BART determinations for Danskammer Generating Station under New York Regional Haze State Implementation Plan and Federal Implementation Plan, 77 FR 51915 (August 28, 2012).
- Prepared cost analyses and comments on NOx BART determinations for Regional Haze State Implementation Plan for State of Nevada, 77 FR 23191 (April 18, 2012) and 77 FR 25660 (May 1, 2012).
- Prepared analyses of and comments on New Source Performance Standards for Greenhouse Gas Emissions for New Stationary Sources: Electric Utility Generating Units, 77 FR 22392 (April 13, 2012).
- Prepared comments on CASPR-BART emission equivalency and NOx and PM BART determinations in EPA proposed approval of State Implementation Plan for Pennsylvania Regional Haze Implementation Plan, 77 FR 3984 (January 26, 2012).
- Prepared comments and statistical analyses on hazardous air pollutants (HAPs) emission controls, monitoring, compliance methods, and the use of surrogates for acid gases, organic HAPs, and metallic HAPs for proposed National Emission Standards for Hazardous Air Pollutants from Coal- and Oil-Fired Electric Utility Steam Generating Units, 76 FR 24976 (May 3, 2011).
- Prepared cost analyses and comments on NOx BART determinations and emission reductions for proposed Federal Implementation Plan for Four Corners Power Plant, 75 FR 64221 (October 19, 2010).
- Prepared cost analyses and comments on NOx BART determinations for Colstrip Units 1- 4 for Montana State Implementation Plan and Regional Haze Federal Implementation Plan, 77 FR 23988 (April 20, 2010).
- For EPA Region 8, prepared report: Revised BART Cost Effectiveness Analysis for Tail-End Selective Catalytic Reduction at the Basin Electric Power Cooperative Leland Olds Station Unit 2 Final Report, March 2011, in support of 76 FR 58570 (Sept. 21, 2011).
- For EPA Region 6, prepared report: Revised BART Cost-Effectiveness Analysis for Selective Catalytic Reduction at the Public Service Company of New Mexico San Juan Generating Station, November 2010, in support of 76 FR 52388 (Aug. 22, 2011).

- For EPA Region 6, prepared report: Revised BART Cost-Effectiveness Analysis for Flue Gas Desulfurization at Coal-Fired Electric Generating Units in Oklahoma: Sooner Units 1 & 2, Muskogee Units 4 & 5, Northeastern Units 3 &4, October 2010, in support of 76 FR 16168 (March 26, 2011). My work was upheld in: *State of Oklahoma v. EPA*, App. Case 12-9526 (10th Cri. July 19, 2013).
- Identified errors in N_2O emission factors in the Mandatory Greenhouse Gas Reporting Rule, 40 CFR 98, and prepared technical analysis to support Petition for Rulemaking to Correct Emissions Factors in the Mandatory Greenhouse Gas Reporting Rule, filed with EPA on 10/28/10.
- Assisted interested parties develop input for and prepare comments on the Information Collection Request for Petroleum Refinery Sector NSPS and NESHAP Residual Risk and Technology Review, 75 FR 60107 (9/29/10).
- Technical reviewer of EPA's "Emission Estimation Protocol for Petroleum Refineries," posted for public comments on CHIEF on 12/23/09, prepared in response to the City of Houston's petition under the Data Quality Act (March 2010).
- Prepared comments on SCR cost effectiveness for EPA's Advanced Notice of Proposed Rulemaking, Assessment of Anticipated Visibility Improvements at Surrounding Class I Areas and Cost Effectiveness of Best Available Retrofit Technology for Four Corners Power Plant and Navajo Generating Station, 74 FR 44313 (August 28, 2009).
- Prepared comments on Proposed Rule for Standards of Performance for Coal Preparation and Processing Plants, 74 FR 25304 (May 27, 2009).
- Prepared comments on draft PSD permit for major expansion of midwest refinery to process up to 100% tar sands crudes. Participated in development of monitoring and controls to mitigate impacts and in negotiating a Consent Decree to settle claims in 2008.
- Reviewed and assisted interested parties prepare comments on proposed Kentucky air toxic regulations at 401 KAR 64:005, 64:010, 64:020, and 64:030 (June 2007).
- Prepared comments on proposed Standards of Performance for Electric Utility Steam Generating Units and Small Industrial-Commercial-Industrial Steam Generating Units, 70 FR 9706 (February 28, 2005).
- Prepared comments on Louisville Air Pollution Control District proposed Strategic Toxic Air Reduction regulations.
- Prepared comments and analysis of BAAQMD Regulation, Rule 11, Flare Monitoring at Petroleum Refineries.
- Prepared comments on Proposed National Emission Standards for Hazardous Air Pollutants; and, in the Alternative, Proposed Standards of Performance for New and Existing Stationary

Sources: Electricity Utility Steam Generating Units (MACT standards for coal-fired power plants).

- Prepared Authority to Construct Permit for remediation of a large petroleum-contaminated site on the California Central Coast. Negotiated conditions with agencies and secured permits.
- Prepared Authority to Construct Permit for remediation of a former oil field on the California Central Coast. Participated in negotiations with agencies and secured permits.
- Prepared and/or reviewed hundreds of environmental permits, including NPDES, UIC, Stormwater, Authority to Construct, Prevention of Significant Deterioration, Nonattainment New Source Review, Title V, and RCRA, among others.
- Participated in the development of the CARB document, *Guidance for Power Plant Siting and Best Available Control Technology*, including attending public workshops and filing technical comments.
- Performed data analyses in support of adoption of emergency power restoration standards by the California Public Utilities Commission for "major" power outages, where major is an outage that simultaneously affects 10% of the customer base.
- Drafted portions of the Good Neighbor Ordinance to grant Contra Costa County greater authority over safety of local industry, particularly chemical plants and refineries.
- Participated in drafting BAAQMD Regulation 8, Rule 28, Pressure Relief Devices, including participation in public workshops, review of staff reports, draft rules and other technical materials, preparation of technical comments on staff proposals, research on availability and costs of methods to control PRV releases, and negotiations with staff.
- Participated in amending BAAQMD Regulation 8, Rule 18, Valves and Connectors, including participation in public workshops, review of staff reports, proposed rules and other supporting technical material, preparation of technical comments on staff proposals, research on availability and cost of low-leak technology, and negotiations with staff.
- Participated in amending BAAQMD Regulation 8, Rule 25, Pumps and Compressors, including participation in public workshops, review of staff reports, proposed rules, and other supporting technical material, preparation of technical comments on staff proposals, research on availability and costs of low-leak and seal-less technology, and negotiations with staff.
- Participated in amending BAAQMD Regulation 8, Rule 5, Storage of Organic Liquids, including participation in public workshops, review of staff reports, proposed rules, and other supporting technical material, preparation of technical comments on staff proposals, research on availability and costs of controlling tank emissions, and presentation of testimony before the Board.

- Participated in amending BAAQMD Regulation 8, Rule 18, Valves and Connectors at Petroleum Refinery Complexes, including participation in public workshops, review of staff reports, proposed rules and other supporting technical material, preparation of technical comments on staff proposals, research on availability and costs of low-leak technology, and presentation of testimony before the Board.
- Participated in amending BAAQMD Regulation 8, Rule 22, Valves and Flanges at Chemical Plants, etc, including participation in public workshops, review of staff reports, proposed rules, and other supporting technical material, preparation of technical comments on staff proposals, research on availability and costs of low-leak technology, and presentation of testimony before the Board.
- Participated in amending BAAQMD Regulation 8, Rule 25, Pump and Compressor Seals, including participation in public workshops, review of staff reports, proposed rules, and other supporting technical material, preparation of technical comments on staff proposals, research on availability of low-leak technology, and presentation of testimony before the Board.
- Participated in the development of the BAAQMD Regulation 2, Rule 5, Toxics, including participation in public workshops, review of staff proposals, and preparation of technical comments.
- Participated in the development of SCAQMD Rule 1402, Control of Toxic Air Contaminants from Existing Sources, and proposed amendments to Rule 1401, New Source Review of Toxic Air Contaminants, in 1993, including review of staff proposals and preparation of technical comments on same.
- Participated in the development of the Sunnyvale Ordinance to Regulate the Storage, Use and Handling of Toxic Gas, which was designed to provide engineering controls for gases that are not otherwise regulated by the Uniform Fire Code.
- Participated in the drafting of the Statewide Water Quality Control Plans for Inland Surface Waters and Enclosed Bays and Estuaries, including participation in workshops, review of draft plans, preparation of technical comments on draft plans, and presentation of testimony before the SWRCB.
- Participated in developing Se permit effluent limitations for the five Bay Area refineries, including review of staff proposals, statistical analyses of Se effluent data, review of literature on aquatic toxicity of Se, preparation of technical comments on several staff proposals, and presentation of testimony before the Bay Area RWQCB.
- Represented the California Department of Water Resources in the 1991 Bay-Delta Hearings before the State Water Resources Control Board, presenting sworn expert testimony with cross examination and rebuttal on a striped bass model developed by the California Department of Fish and Game.

- Represented the State Water Contractors in the 1987 Bay-Delta Hearings before the State Water Resources Control Board, presenting sworn expert testimony with cross examination and rebuttal on natural flows, historical salinity trends in San Francisco Bay, Delta outflow, and hydrodynamics of the South Bay.
- Represented interveners in the licensing of over 20 natural-gas-fired power plants and one coal gasification plant at the California Energy Commission and elsewhere. Reviewed and prepared technical comments on applications for certification, preliminary staff assessments, final staff assessments, preliminary determinations of compliance, final determinations of compliance, and prevention of significant deterioration permits in the areas of air quality, water supply, water quality, biology, public health, worker safety, transportation, site contamination, cooling systems, and hazardous materials. Presented written and oral testimony in evidentiary hearings with cross examination and rebuttal. Participated in technical workshops.
- Represented several parties in the proposed merger of San Diego Gas & Electric and Southern California Edison. Prepared independent technical analyses on health risks, air quality, and water quality. Presented written and oral testimony before the Public Utilities Commission administrative law judge with cross examination and rebuttal.
- Represented a PRP in negotiations with local health and other agencies to establish impact of subsurface contamination on overlying residential properties. Reviewed health studies prepared by agency consultants and worked with agencies and their consultants to evaluate health risks.

WATER QUALITY/RESOURCES

- Directed and participated in research on environmental impacts of energy development in the Colorado River Basin, including contamination of surface and subsurface waters and modeling of flow and chemical transport through fractured aquifers.
- Played a major role in Northern California water resource planning studies since the early 1970s. Prepared portions of the Basin Plans for the Sacramento, San Joaquin, and Delta basins including sections on water supply, water quality, beneficial uses, waste load allocation, and agricultural drainage. Developed water quality models for the Sacramento and San Joaquin Rivers.
- Conducted hundreds of studies over the past 40 years on Delta water supplies and the impacts of exports from the Delta on water quality and biological resources of the Central Valley, Sacramento-San Joaquin Delta, and San Francisco Bay. Typical examples include:

    1. Evaluate historical trends in salinity, temperature, and flow in San Francisco Bay and upstream rivers to determine impacts of water exports on the estuary;

2. Evaluate the role of exports and natural factors on the food web by exploring the relationship between salinity and primary productivity in San Francisco Bay, upstream rivers, and ocean;
3. Evaluate the effects of exports, other in-Delta, and upstream factors on the abundance of salmon and striped bass;
4. Review and critique agency fishery models that link water exports with the abundance of striped bass and salmon;
5. Develop a model based on GLMs to estimate the relative impact of exports, water facility operating variables, tidal phase, salinity, temperature, and other variables on the survival of salmon smolts as they migrate through the Delta;
6. Reconstruct the natural hydrology of the Central Valley using water balances, vegetation mapping, reservoir operation models to simulate flood basins, precipitation records, tree ring research, and historical research;
7. Evaluate the relationship between biological indicators of estuary health and down-estuary position of a salinity surrogate (X2);
8. Use real-time fisheries monitoring data to quantify impact of exports on fish migration;
9. Refine/develop statistical theory of autocorrelation and use to assess strength of relationships between biological and flow variables;
10. Collect, compile, and analyze water quality and toxicity data for surface waters in the Central Valley to assess the role of water quality in fishery declines;
11. Assess mitigation measures, including habitat restoration and changes in water project operation, to minimize fishery impacts;
12. Evaluate the impact of unscreened agricultural water diversions on abundance of larval fish;
13. Prepare and present testimony on the impacts of water resources development on Bay hydrodynamics, salinity, and temperature in water rights hearings;
14. Evaluate the impact of boat wakes on shallow water habitat, including interpretation of historical aerial photographs;
15. Evaluate the hydrodynamic and water quality impacts of converting Delta islands into reservoirs;
16. Use a hydrodynamic model to simulate the distribution of larval fish in a tidally influenced estuary;
17. Identify and evaluate non-export factors that may have contributed to fishery declines, including predation, shifts in oceanic conditions, aquatic toxicity from

pesticides and mining wastes, salinity intrusion from channel dredging, loss of riparian and marsh habitat, sedimentation from upstream land alternations, and changes in dissolved oxygen, flow, and temperature below dams.

- Developed, directed, and participated in a broad-based research program on environmental issues and control technology for energy industries including petroleum, oil shale, coal mining, and coal slurry transport. Research included evaluation of air and water pollution, development of novel, low-cost technology to treat and dispose of wastes, and development and application of geohydrologic models to evaluate subsurface contamination from in-situ retorting. The program consisted of government and industry contracts and employed 45 technical and administrative personnel.
- Coordinated an industry task force established to investigate the occurrence, causes, and solutions for corrosion/erosion and mechanical/engineering failures in the waterside systems (e.g., condensers, steam generation equipment) of power plants. Corrosion/erosion failures caused by water and steam contamination that were investigated included waterside corrosion caused by poor microbiological treatment of cooling water, steam-side corrosion caused by ammonia-oxygen attack of copper alloys, stress-corrosion cracking of copper alloys in the air cooling sections of condensers, tube sheet leaks, oxygen in-leakage through condensers, volatilization of silica in boilers and carry over and deposition on turbine blades, and iron corrosion on boiler tube walls. Mechanical/engineering failures investigated included: steam impingement attack on the steam side of condenser tubes, tube-to-tube-sheet joint leakage, flow-induced vibration, structural design problems, and mechanical failures due to stresses induced by shutdown, startup and cycling duty, among others. Worked with electric utility plant owners/operators, condenser and boiler vendors, and architect/engineers to collect data to document the occurrence of and causes for these problems, prepared reports summarizing the investigations, and presented the results and participated on a committee of industry experts tasked with identifying solutions to prevent condenser failures.
- Evaluated the cost effectiveness and technical feasibility of using dry cooling and parallel dry-wet cooling to reduce water demands of several large natural-gas fired power plants in California and Arizona.
- Designed and prepared cost estimates for several dry cooling systems (e.g., fin fan heat exchangers) used in chemical plants and refineries.
- Designed, evaluated, and costed several zero liquid discharge systems for power plants.
- Evaluated the impact of agricultural and mining practices on surface water quality of Central Valley steams. Represented municipal water agencies on several federal and state advisory committees tasked with gathering and assessing relevant technical information, developing work plans, and providing oversight of technical work to investigate toxicity issues in the watershed.

AIR QUALITY/PUBLIC HEALTH

- Prepared or reviewed the air quality and public health sections of hundreds of EIRs and EISs on a wide range of industrial, commercial and residential projects.
- Prepared or reviewed hundreds of NSR and PSD permits for a wide range of industrial facilities.
- Designed, implemented, and directed a 2-year-long community air quality monitoring program to assure that residents downwind of a petroleum-contaminated site were not impacted during remediation of petroleum-contaminated soils. The program included real-time monitoring of particulates, diesel exhaust, and BTEX and time integrated monitoring for over 100 chemicals.
- Designed, implemented, and directed a 5-year long source, industrial hygiene, and ambient monitoring program to characterize air emissions, employee exposure, and downwind environmental impacts of a first-generation shale oil plant. The program included stack monitoring of heaters, boilers, incinerators, sulfur recovery units, rock crushers, API separator vents, and wastewater pond fugitives for arsenic, cadmium, chlorine, chromium, mercury, 15 organic indicators (e.g., quinoline, pyrrole, benzo(a)pyrene, thiophene, benzene), sulfur gases, hydrogen cyanide, and ammonia. In many cases, new methods had to be developed or existing methods modified to accommodate the complex matrices of shale plant gases.
- Conducted investigations on the impact of diesel exhaust from truck traffic from a wide range of facilities including mines, large retail centers, light industrial uses, and sports facilities. Conducted traffic surveys, continuously monitored diesel exhaust using an aethalometer, and prepared health risk assessments using resulting data.
- Conducted indoor air quality investigations to assess exposure to natural gas leaks, pesticides, molds and fungi, soil gas from subsurface contamination, and outgasing of carpets, drapes, furniture and construction materials. Prepared health risk assessments using collected data.
- Prepared health risk assessments, emission inventories, air quality analyses, and assisted in the permitting of over 70 1 to 2 MW emergency diesel generators.
- Prepare over 100 health risk assessments, endangerment assessments, and other health-based studies for a wide range of industrial facilities.
- Developed methods to monitor trace elements in gas streams, including a continuous real-time monitor based on the Zeeman atomic absorption spectrometer, to continuously measure mercury and other elements.

- Performed nuisance investigations (odor, noise, dust, smoke, indoor air quality, soil contamination) for businesses, industrial facilities, and residences located proximate to and downwind of pollution sources.

PUBLICATIONS AND PRESENTATIONS (Partial List - Representative Publications)

J.P. Fox, P.H. Hutton, D.J. Howes, A.J. Draper, and L. Sears, Reconstructing the Natural Hydrology of the San Francisco Bay-Delta Watershed, Hydrology and Earth System Sciences, Special Issue: Predictions under Change: Water, Earth, and Biota in the Anthropocene, v. 19, pp. 4257-4274, 2015. http://www.hydrol-earth-syst-sci.net/19/4257/2015/hess-19-4257-2015.pdf.

D.J. Howes, P. Fox, and P. Hutton, Evapotranspiration from Natural Vegetation in the Central Valley of California: Monthly Grass Reference Based Vegetation Coefficients and the Dual Crop Coefficient Approach, Accepted for Publication in *Journal of Hydrologic Engineering*, October 13, 2014.

Phyllis Fox and Lindsey Sears, *Natural Vegetation in the Central Valley of California*, June 2014, Prepared for State Water Contractors and San Luis & Delta-Mendota Water Authority, 311 pg.

J.P. Fox, T.P. Rose, and T.L. Sawyer, Isotope Hydrology of a Spring-fed Waterfall in Fractured Volcanic Rock, 2007.

C.E. Lambert, E.D. Winegar, and Phyllis Fox, Ambient and Human Sources of Hydrogen Sulfide: An Explosive Topic, Air & Waste Management Association, June 2000, Salt Lake City, UT.

San Luis Obispo County Air Pollution Control District and San Luis Obispo County Public Health Department, *Community Monitoring Program,* February 8, 1999.

The Bay Institute, *From the Sierra to the Sea. The Ecological History of the San Francisco Bay-Delta Watershed*, 1998.

J. Phyllis Fox, *Well Interference Effects of HDPP's Proposed Wellfield in the Victor Valley Water District*, Prepared for the California Unions for Reliable Energy (CURE), October 12, 1998.

J. Phyllis Fox, *Air Quality Impacts of Using CPVC Pipe in Indoor Residential Potable Water Systems*, Report Prepared for California Pipe Trades Council, California Firefighters Association, and other trade associations, August 29, 1998.

J. Phyllis Fox and others, *Authority to Construct Avila Beach Remediation Project*, Prepared for Unocal Corporation and submitted to San Luis Obispo Air Pollution Control District, June 1998.

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J. Phyllis Fox and Robert Sears, *Health Risk Assessment for the Metropolitan Oakland International Airport Proposed Airport Development Program*, Prepared for Plumbers & Steamfitters U.A. Local 342, December 15, 1997.

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Phyllis Fox and Jeff Miller, "Fathead Minnow Mortality in the Sacramento River," *IEP Newsletter*, v. 9, n. 3, 1996.

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Phyllis Fox and Elaine Archibald, *Aquatic Toxicity and Pesticides in Surface Waters of the Central Valley*, California Urban Water Agencies (CUWA) Report, September 1997.

Phyllis Fox and Alison Britton, *Evaluation of the Relationship Between Biological Indicators and the Position of X2*, CUWA Report, 1994.

Phyllis Fox and Alison Britton, *Predictive Ability of the Striped Bass Model*, WRINT DWR-206, 1992.

J. Phyllis Fox, *An Historical Overview of Environmental Conditions at the North Canyon Area of the Former Solano County Sanitary Landfill*, Report Prepared for Solano County Department of Environmental Management, 1991.

J. Phyllis Fox, *An Historical Overview of Environmental Conditions at the East Canyon Area of the Former Solano County Sanitary Landfill*, Report Prepared for Solano County Department of Environmental Management, 1991.

Phyllis Fox, *Trip 2 Report, Environmental Monitoring Plan, Parachute Creek Shale Oil Program*, Unocal Report, 1991.

J. P. Fox and others, "Long-Term Annual and Seasonal Trends in Surface Salinity of San Francisco Bay," *Journal of Hydrology*, v. 122, p. 93-117, 1991.

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J. P. Fox, "El Mercurio en el Medio Ambiente: Aspectos Referentes al Peru," (Mercury in the Environment: Factors Relevant to Peru) Proceedings of Simposio Los Pesticidas y el Medio Ambiente," ONERN-CONCYTEC, Lima, Peru, April 25-27, 1984. (Also presented at Instituto Tecnologico Pesquero and Instituto del Mar del Peru.)

J. P. Fox, "Mercury, Fish, and the Peruvian Diet," *Boletin de Investigacion*, Instituto Tecnologico Pesquero, Lima, Peru, v. 2, no. 1, pp. 97-116, 1984.

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